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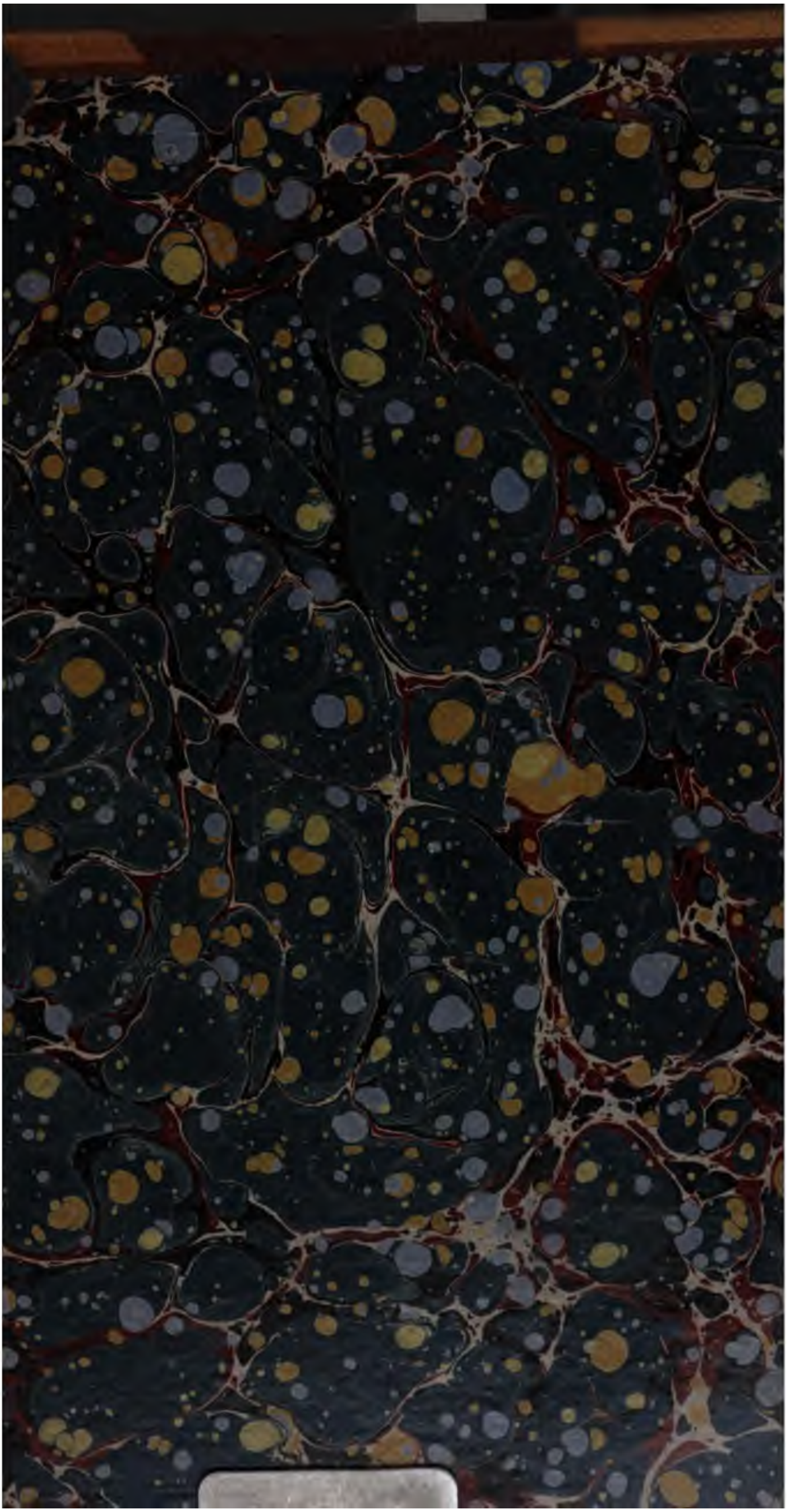

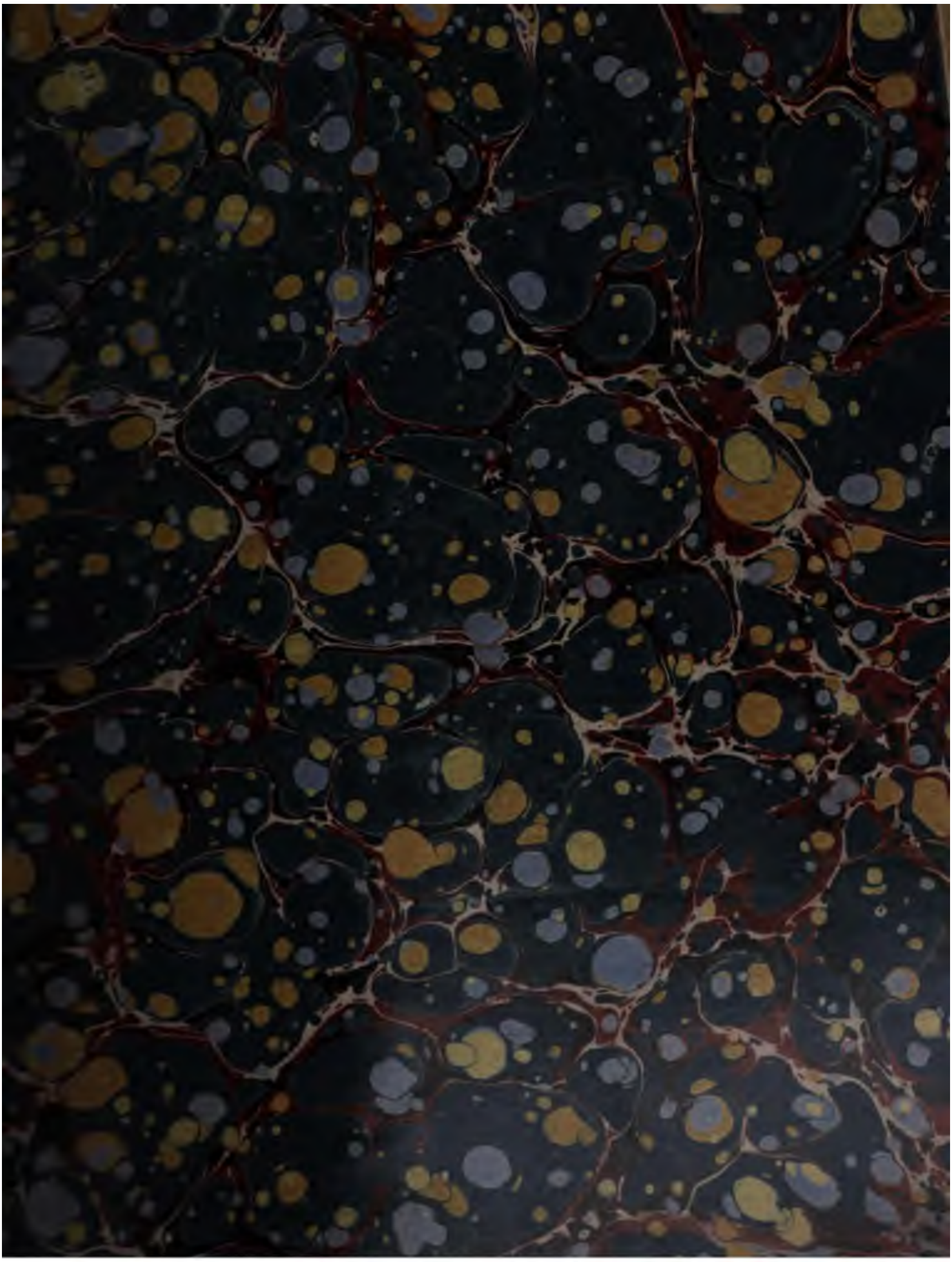

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1897.

THE REPTILES

OF THE

PACIFIC COAST AND GREAT BASIN

AN ACCOUNT OF THE SPECIES KNOWN TO INHABIT

CALIFORNIA,

AND

Oregon, Washington, Idaho and Nevada.

BY

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SAN FRANCISCO:
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PREFACE.

The life histories of our reptiles remain almost entirely unknown. Herpetologists are so few, and reptiles so retiring, that, unless more general interest can be aroused, we may hope for very little light upon this important branch of the science. Many specialists in other departments of science, as well as hunters, farmers, students, and other intelligent men, however, are constantly in the field and might record observations of great interest were means of identification at hand. This paper has been prepared in the hope that it may stimulate those whose mode of life leads them into the woods and fields to study the ways of our reptiles—by no means the least interesting, if amongst the more humble, of the animals about us.

Although it has not been thought advisable to "popularize" the descriptions in the following pages, such characters as cannot be determined without dissection have been avoided. For this reason the synopses and characterizations of the higher groups are very artificial and are not intended to hold good if applied to extralimital species or genera. Likewise, superfamilies, subfamilies, and subgenera have not been introduced. While this is, thus, intended as a handbook for the more or less casual student, it is hoped that the professional herpetologist will find something of interest regarding the variation and distribution of our reptiles.

I wish especially to express my obligation to Dr. Leonhard Stejneger, who placed at my disposal the entire collection of reptiles belonging to the United

States National Museum; to Mr. Henry H. Hindshaw, Curator of the Museum of the University of Washington, who sent me a collection of species from western Washington; to Mr. John Fannin, Curator of the Provincial Museum, Victoria, B.C., who lent me the collection belonging to his institution; to Prof. W. E. Ritter, of the University of California, for a similar favor; to Dr. G. Baur; to Mr. Harold Heath; to Dr. W. W. Thoburn; to Mr. Douglas Van Denburgh; to Mr. Edward Hyatt; to Mr. J. M. Hyde; to Mr. J. O. Snyder; to Dr. G. Eisen; to many others; and most of all to Dr. Chas. H. Gilbert, who forwarded to me the unequaled collection of Californian reptiles belonging to Leland Stanford Junior University, and gathered for that institution by his untiring zeal.

THE AUTHOR.

San Francisco, April, 1897.

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THE REPTILES OF THE PACIFIC COAST AND GREAT BASIN.

INTRODUCTION.

The term reptile is popularly applied to all cold-blooded vertebrates other than fishes. Thus used it includes two groups of animals which differ in many important respects. These are the batrachians and the reptiles proper; the former more closely allied to the fishes; the latter, to the birds.

The typical batrachians, such as most frogs, toads, salamanders, etc., lay their eggs in the water, and the young, for a time, breathe by means of gills, very much as do the fishes. Later on, they undergo a metamorphosis, during which the gills and other larval characteristics disappear, the tadpole assumes the form and structure of its parents and emerges from the water to breathe air and spend a greater or less portion of its life on land. The skin of batrachians* is not provided with scales, but is smooth or warty, very glandular, and often covered with a slimy secretion.

The true reptiles, such as alligators, turtles, lizards, and snakes, on the other hand, never lay their eggs in the water, even the marine species coming to land for this purpose. Their young never breathe by means of gills, but are hatched or born with the form and structure of the adult. The skin, except of some turtles, is covered with scales, and is dry, never slimy.

There are, also, many anatomical and embryological differences between the two classes, but these need not be mentioned here, since the batrachians will not be considered in the following pages. Our reptiles and batrachians may be distinguished by the following

---

*Except Cœcilians of tropical lands.

SYNOPSIS OF CLASSES.

a.—Anal opening transverse or round; skin furnished with scales (varying from large plates to minute granules); or, if skin smooth (*Pelodiscus*), tail and claws present and jaws without teeth. (Turtles, lizards, snakes, etc.)........................ Reptilia.—p. 28.

a^2.—Anal opening longitudinal or round; skin smooth or warty, without scales; no claws.* (Frogs, toads, salamanders, newts, water-dogs, tadpoles, etc.)................................ Batrachia.

Long ago the reptiles were the rulers of the earth as the mammals are to-day. Huge monsters, most grotesquely fashioned, roamed over the land, while equally large reptiles swam in the seas, and in the air were great creatures whose bat-like wings, it is said, sometimes measured more than twenty feet from tip to tip. But of these monsters, none remain alive; only the smaller forms have survived. Living reptiles fall naturally into four groups or orders. One of these orders contains but a single lizard-like animal, the *Sphenodon* of New Zealand, interesting to the morphologist because of its generalized structure. The other three orders are numerously represented in the warmer portions of both the Old and New Worlds. They are: first, the alligators and crocodiles; second, the turtles; third, the lizards and the snakes.

The alligators and crocodiles are of chiefly tropical and subtropical distribution and do not enter the territory we are considering. The turtles are most numerous in moist regions, and, consequently, are represented on the Pacific Coast and in the Great Basin by few species. The lizards and snakes, on the contrary, find

---

*** Tips of digits sometimes horny.**

our warm, dry climate well adapted to their needs, and are very numerous. In the following pages I have admitted to the fauna of the states under consideration seventy-seven species and subspecies of reptiles belonging to thirty-seven genera, thirteen families, and two orders. Of these, three are turtles, forty are lizards, and thirty-four snakes.

While it is probable that no two of these species have exactly the same geographical limits, yet the ranges of certain species are, in a general way, conterminous with those not only of other reptiles but of other kinds of animals as well. Thus, if we map out the areas occupied by the different kinds of mammals, birds, reptiles, insects, plants, etc., we find that the boundaries of the ranges of many species are nearly coincident, so that in one area we have certain genera and species associated, while more or less closely related kinds inhabit adjoining districts. From such study of its animals and plants temperate North America has been divided into a number of life zones,* each of which may be subdivided into minor areas technically known as Faunæ.

When regarded from a herpetological standpoint, California may be divided into five minor life areas, each of which corresponds more or less closely with one of the chief physical areas of the State. Thus, one biologic area occupies the southeastern deserts, another the southern coast, a third the western slopes of the northern coastal ranges, a fourth a belt along the Sierra Nevada, and a fifth the great interior valleys of the Sacramento and San Joaquin together with their fringing foothills.

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* On this subject see especially Allen, Bull. Am Mus. N. H., IV, 1, 1892, pp. 199-244; Auk , X, 2, Apr., 1893; Merriam, N. A. Fauna, No. 3, 1890, and No. 5, 1891; Proc. Biol. Soc. Wash. VII, pp. 1-64, 1892; Nat. Geog. Mag., 1894; Rep. Sec. Agri., 1893, pp. 228, 229 (1894).

Each of these areas is characterized by the presence of certain species which do not live in the others, and the absence of other species peculiar to the adjoining Faunæ. Other species, though not restricted to one, conform more or less closely to the geographical limits of two or more of these life areas. Without stopping to speculate upon the causes which, severally or in combination, have operated to bring about this arrangement, let us consider each of these areas in detail, pointing out its faunal peculiarities and relations to the others.

The reptilian fauna of California, as at present known, is composed of seventy-one species and subspecies. The following table shows the area or areas which each of these is known to inhabit:

DISTRIBUTION OF CALIFORNIAN REPTILES.

SPECIES AND SUBSPECIES.	Sierra Nevada	Northern Coast	Valleys	Southern Coast	Desert
Clemmys marmorata		x	x	x	
Chrysemys bellii (?)			?		
Gopherus agassizii					x
Coleonyx variegatus					x
Dipsosaurus dorsalis					x
Uma notata					x
inornata					x
Callisaurus ventralis					x
Crotaphytus baileyi					x
wislizenii					x
silus			x		
Sauromalus ater					x
Uta mearnsi				x	
stansburiana			x	x	x
graciosa					x
symmetrica					x

DISTRIBUTION OF CALIFORNIAN REPTILES—Continued.

SPECIES AND SUBSPECIES.	Sierra Nevada	Northern Coast	Valleys	Southern Coast	Desert
Sceloporus graciosus	x			*	
occidentalis		x	x		
biseriatus			x	x	?
magister					x
orcutti				x	
Phrynosoma douglassii		?			
blainvillii				x	
frontale			x		
platyrhinos					x
m'callii					x
Gerrhonotus scincicauda		x	x	x	
burnettii		x			
principis (?)	?				
palmeri	x				
Anniella pulchra			x	x	
nigra		x			
Xantusia vigilis					x
henshawi				x	
riversiana				?	
Cnemidophorus tigris					x
undulatus			x		
stejnegeri				x	
Verticaria hyperythra beldingi				x	
Eumeces skiltonianus	x	x	x	x	
gilberti	x				
Siagonodon humilis					x
Lichanura roseofusca				x	
Charina bottæ	x	x	x		
Chilomeniscus ephippicus					x
Chionactis occipitalis					x
Contia mitis		x	x		
Diadophis amabilis	x	x	x	x	
Lampropeltis zonata	x	x	?	?	
boylii	?	?	x	x	
californiæ			x	x	
Rhinocheilus lecontei			x	x	x
Tantilla eiseni			x		
Hypsiglena ochrorhynchus				x	x
Salvadora grahamiæ				x	x
Bascanion constrictor vetustum	x	x	x	x	
flagellum frenatum			x	x	x
laterale			x	x	
tæniatum			?		x

---

* In mountains only.

DISTRIBUTION OF CALIFORNIAN REPTILES—Concluded.

SPECIES AND SUBSPECIES.	Sierra Nevada	Northern Coast	Valleys	Southern Coast	Desert
Arizona elegans				x	?
Pituophis catenifer		x	x	x	
deserticola					x
Thamnophis parietalis	x	x	x	x	
elegans	x	x	x		
vagrans	x		x		x
hammondii			x	x	x
Crotalus lucifer	x	x	x	x	
tigris					x
cerastes					x
mitchellii					x
ruber				x	

The Desert Fauna.—The Colorado and Mojave Deserts with western and northern arms, one of which invades the southern part of the San Joaquin Valley, constitute the Californian portion of what may here be termed the Desert Fauna. This Fauna, as we have seen, is inhabited by thirty-one (or thirty-three) species and subspecies of reptiles, of which the following twenty-three (or twenty-four) occur in no other area of the State:

Gopherus agassizii,
Coleonyx variegatus,
Dipsosaurus dorsalis,
Uma notata,
Uma inornata,
Callisaurus ventralis,
Crotaphytus baileyi,
Crotaphytus wislizenii,
Sauromalus ater,
Uta graciosa,
Uta symmetrica,
Sceloporus magister,
Phrynosoma platyrhinos,
Phrynosoma m'callii,
Xantusia vigilis,
Cnemidophorus tigris,
Siagonodon humilis,
Chilomeniscus ephippicus,
Chionactis occipitalis,
Bascanion tæniatum (?),
Pituophis catenifer deserticola,
Crotalus tigris,
Crotalus cerastes,
Crotalus mitchellii.

This area shares with the southern coast or San Diegan Fauna alone only *Hypsiglena ochrorhynchus*, *Salvadora grahamiæ*, and probably *Arizona elegans*, and with the valleys or Californian Fauna possibly *Bascanion tæniatum*, while in common with both these areas it has *Uta stansburiana*, *Rhinocheilus lecontei*, *Bascanion flagellum frenatum*, *Thamnophis hammondii*, and perhaps *Sceloporus biseriatus*. Moreover, it lacks twenty-seven (or thirty-three) species and subspecies which occur in one or both of these adjoining Faunæ, and possesses none of those found in the Sierra Nevada and northern coast areas. The Desert Fauna is the most distinct of the minor life areas of California.

The San Diegan Fauna.—This area comprises the western portions or coastal slopes of San Diego, Riverside, Orange, San Bernardino, and Los Angeles Counties, excepting the higher lands, which belong rather with the Sierra Nevada. It is, in the main, a warmer and dryer area than the Californian Fauna, to which it is most closely allied.

The reptiles of this Fauna are twenty-eight (or thirty) in number, of which the following eight (or nine) are peculiar to it:

Uta mearnsi,
Sceloporus orcutti,
Phrynosoma blainvillii,
Xantusia henshawi,
Xantusia riversiana,*
Cnemidophorus stejnegeri,
Verticaria hyperythra beldingi,
Lichanura roseofusca,†
Crotalus ruber.

It shares with only the Desert Fauna *Hypsiglena ochrorhynchus*, *Salvadora grahamiæ*, and probably *Arizona elegans;* with the Californian Fauna, *Anniella pulchra*, *Lampropeltis californiæ*, *Bascanion laterale*, and perhaps

---

* Insular.

† Occurs also near Tucson, Ariz.

Sceloporus biseriatus and *Lampropeltis boylii;* and with both these Faunæ, *Uta stansburiana, Rhinocheilus lecontei, Bascanion flagellum frenatum, Thamnophis hammondii,* and perhaps *Sceloporus biseriatus.* It lacks twenty-five species and subspecies of the Desert Fauna, and eight (or nine) of the Californian. Some species are common to it and to one or both of the northern areas—Sierra Nevadan and Pacific. The San Diegan Fauna is most closely allied to the Californian.

The Californian Fauna.—The Californian Fauna includes the western slope of the Sierra Nevada below the Sierra Nevadan Fauna, and extends thence westward to the ocean, excepting the area along the coast which constitutes the Pacific Fauna and that part of the San Joaquin Valley which belongs to the Desert Fauna. It appears to reach the coast in Ventura, Santa Barbara and San Luis Obispo Counties. Twenty-six (or twenty-nine) reptiles have been found within its limits. Of these, four are peculiar to it, as follows:

Crotaphytus silus,
Phrynosoma frontale,
Cnemidophorus tigris undulatus,
Tantilla eiseni.

It shares with the Desert Fauna alone possibly *Bascanion tæniatum;* with the Desert and San Diegan Faunæ, *Uta stansburiana, Rhinocheilus lecontei, Bascanion flagellum frenatum, Thamnophis hammondii,* and perhaps *Sceloporus biseriatus;* with the San Diegan Fauna alone, *Anniella pulchra, Lampropeltis californiæ, Bascanion laterale,* and perhaps *Sceloporus biseriatus* and *Lampropeltis boylii;* with the Pacific Fauna alone, *Sceloporus occidentalis;* with the Pacific and San Diegan Faunæ, *Clemmys marmorata* and *Gerrhonotus scincicauda;* and with all except the Desert Fauna, *Eumeces skiltonianus, Diadophis amabilis, Bascanion constrictor vetustum, Tham-*

nophis parietalis, *Crotalus lucifer*, and perhaps *Lampropeltis zonata* and *Lampropeltis boylii*. It lacks twenty-five (or twenty-seven) reptiles of the Desert Fauna, eleven (or twelve) of the San Diegan, two (or three) of the Pacific, and three (or five) of the Sierra Nevadan. The Californian Fauna is most closely allied to the San Diegan.

The Pacific Fauna.—The Pacific Fauna occupies a narrow strip along the coast as far south as Monterey County.* In the northern part of the State it widens and merges with the Sierra Nevadan, to which it is closely allied, but farther south it is confined to the western slope of the outer Coast Range. It is inhabited by fifteen (or seventeen) kinds of reptiles. Of these, *Gerrhonotus burnettii* and *Anniella nigra* are peculiar. *Sceloporus occidentalis* and *Contia mitis* it shares with the Californian Fauna only. *Lampropeltis zonata* is perhaps confined to this and the Sierra Nevadan Faunæ. Its other species are wide-ranging. It lacks thirteen (or sixteen) reptiles of the Californian Fauna, and four (or five) of the Sierra Nevadan. This Fauna is much better characterized by its batrachians, birds, and other animals than by its reptiles.

The Sierra Nevadan Fauna.—The fifth life area of California occupies a belt along the western (and eastern also?) side of the Sierra Nevada. One at least of its reptiles reappears in the mountains of San Diego and Riverside Counties. Twelve (or fourteen) kinds of reptiles have been taken in this area. *Gerrhonotus palmeri* and *Eumeces gilberti* are peculiar to it. *Sceloporus graciosus* occurs here but in no other part of California except the mountains of the southern part of the State.

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* Probably to Santa Barbara in mountains.

Gerrhonotus principis perhaps is one of its inhabitants. *Lampropeltis zonata* may be peculiar to it and the Pacific Fauna. The other reptiles of the area are of rather wide distribution. It lacks seven (or eight) species of the Pacific Fauna, and seventeen (or twenty) of the Californian.

We have seen that there are five life areas in California* and that some of these are more closely allied than others. The Desert Fauna bears little resemblance to the San Diegan and Californian, and even less to the Pacific and Sierra Nevadan. Most of its species occur in western Arizona, southern Nevada, and northern Lower California.† It is, in fact, a part of the Lower Austral Zone of Merriam or South Warm Temperate of Allen. The San Diegan and Californian Faunæ have more in common. Apparently both belong to the Upper Austral Zone of Merriam, which is the Middle Warm Temperate of Allen. The Pacific and Sierra Nevadan Faunæ, also, are closely allied. They form a part of the Transition Zone of Merriam or North Warm Temperate of Allen, which, extending northward across western Oregon and Washington, forms another life area, which we may call the Puget Fauna.‡ It would seem then, that these three zones bend suddenly southward (irrespective of altitude) near the Pacific Coast. Thus it happens that their westernmost Faunæ lie north and south of each other instead of east and west—the Desert Fauna north of the San Lucan,§ the Californian north of the San Diegan, the Puget north of the Pacific and Sierra Nevadan.

Too little is known of the reptiles of Oregon, Washington, Idaho, and Nevada to permit anything to be said of their distribution. However, lists of those which have been found in each State are given.

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* The colder portions of the mountains have not been considered.

† Except that part which belongs to the San Diegan Fauna.

‡ This is perhaps a part of the Canadian Zone.

§ The southern end of the peninsula of Lower California.

The following are the reptiles of Oregon:

Clemmys marmorata,
Crotaphytus wislizenii,
Uta stansburiana,
Sceloporus graciosus,
Sceloporus occidentalis,
Sceloporus biseriatus (?),
Phrynosoma douglassii,
Phrynosoma platyrhinos,
Gerrhonotus scincicauda,
Gerrhonotus principis,
Eumeces skiltonianus,
Charina bottæ,
Contia mitis,
Diadophis amabilis,
Bascanion constrictor vetustum,
Bascanion tæniatum,
Pituophis catenifer,
Thamnophis parietalis,
Thamnophis parietalis pickeringii,
Thamnophis leptocephala,
Thamnophis vagrans,
Thamnophis vagrans biscutata,
Crotalus lucifer.

The following reptiles are known to inhabit Washington:

Clemmys marmorata,
Chrysemys bellii,
Sceloporus graciosus,
Sceloporus occidentalis,
Phrynosoma douglassii,
Gerrhonotus principis,
Charina bottæ,
Contia mitis,
Bascanion constrictor vetustum,
Pituophis catenifer,
Thamnophis parietalis,
Thamnophis parietalis pickeringii,
Thamnophis leptocephala,
Thamnophis vagrans,
Thamnophis vagrans biscutata,
Crotalus lucifer.

The reptiles of Idaho are:

Crotaphytus baileyi,
Crotaphytus wislizenii,
Uta stansburiana,
Sceloporus graciosus,
Sceloporus biseriatus,
Phrynosoma douglassii,
Phrynosoma platyrhinos,
Cnemidophorus tigris,
Charina bottæ,
Bascanion constrictor vetustum,
Bascanion tæniatum,
Pituophis catenifer,
Thamnophis parietalis,
Thamnophis vagrans,
Crotalus lucifer,
Crotalus confluentus.

The following species and subspecies have been found in Nevada:

Gopherus agassizii,
Dipsosaurus dorsalis,
Callisaurus ventralis,
Holbrookia maculata approximans,
Crotaphytus baileyi,
Crotaphytus wislizenii,
Sauromalus ater,
Uta stansburiana,
Uta graciosa,
Sceloporus graciosus,
Sceloporus biseriatus,
Sceloporus magister,
Phrynosoma platyrhinos,
Heloderma suspectum,
Cnemidophorus tigris,
Charina bottæ,
Lampropeltis boylii,
Salvadora grahamiæ,
Bascanion flagellum frenatum,
Bascanion tæniatum,
Pituophis catenifer deserticola,
Thamnophis parietalis,
Thamnophis vagrans,
Crotalus lucifer,
Crotalus tigris,
Crotalus cerastes.

Many kinds of reptiles vary so much that it is difficult to find two specimens which are alike in color and squamation. Sometimes the variations correspond with definite geographical areas, as in the case of *Cnemidophorus tigris* and *C. t. undulatus* or *Phrynosoma blainvillii* and *P. frontale*, but more frequently they are purely individual, as in *Charina* and many species of *Thamnophis*. Many reptiles are subject to chameleonic changes, or changes in accordance with the intensity of the light, or with the colors of objects by which they are surrounded. For these reasons the collector should strive to secure many specimens of each species.

Reptiles are to be found in all sorts of situations. The collector should study their habits if he would be successful in his search. Some kinds prefer moist places, while others are most abundant on barren hillsides or on the open desert. As a rule, reptiles like sunlight and warmth, but some species live in the thicker forests, and not a few are nocturnal.

Some reptiles may be caught with the hands unaided by any apparatus. Other species, too agile to be captured thus, may be secured by means of a slip-noose of horse-hair, wild oats, thread, or fine wire, deftly placed over the head of the victim and then tightened with a sudden jerk. However, by far the most satisfactory method of procuring reptiles is to shoot them. For this purpose small charges of fine shot are used in an auxiliary barrel, collecting pistol, or small caliber rifle. The last will prove much more effective if the rifling has been removed. When taken in the hands our reptiles often bite fiercely, but, even if they succeed in drawing blood, none except the rattlesnakes and the Gila Monster can cause any serious injury, for only these are poisonous.

Nothing is better for preserving reptiles than alcohol, though formalin may sometimes be used to advantage when little space is at the collector's disposal. Care should be taken to have the alcohol enter the body cavity, for if it does not do so the specimens will not be well preserved. The alcohol may be injected by means of a hypodermic syringe, or slits may be cut through the skin of the belly. These slits usually should be about half an inch long. One is ordinarily sufficient in case of a lizard, but in snakes several incisions should be made at interval of three or four inches. The specimens having been thus prepared, and labeled with the exact locality and date of collection, as well as with the collector's name and any notes upon habits, colors, etc., should be placed in strong alcohol. Care should be taken not to crowd the specimens into small jars with too little alcohol, for if this be done the reptiles will decay. If the number of jars at hand is so small as to necessitate crowding, the alcohol should be renewed each day until the specimens are thoroughly cured, after which only enough alcohol to cover them is needed.

The descriptions in the following pages are based upon alcoholic specimens, except in a few instances where it is distinctly stated that fresh specimens have been used. Alcohol does not preserve the colors of reptiles well, so that living reptiles usually are more brightly colored than the descriptions indicate. In the determination of colors Ridgway's "Nomenclature of Colors" has been used as a guide. Measurements are given in millimeters, but may readily be converted into inches by allowing twenty-five (25.4) millimeters to one inch. The tail is measured from the anus. Limbs are measured from the side of the body to the tip of the longest toe, excluding the claw. Many of the outline figures of the heads, etc., of snakes are after Baird. Other figures are original, having been drawn by Miss Anna L. Brown. I add here a glossary of some of the terms used in works upon herpetology.

GLOSSARY.

Abdominal.—Pertaining to the lower surface of the body.

Abdominal plates.—Gastrosteges of snakes; the fourth pair of plastral plates of turtles.

Alveolar surface.—Masticatory surfaces just within the cutting edges of the jaws of turtles.

Anal plate.—The large scale just in front of the anus in most snakes, sometimes divided; one of the last pair of plastral plates.

Anteorbital.—See preocular.

Anterior.—Toward the head.

Antocular.—See preocular.

Antorbitar.—See preocular.

Anus.—The external opening of the cloaca.

Axilla.—The armpit.

Axillary.—Plates on the anterior surface of the bridge of turtles.

Azygous.—Single; not one of a pair.

Brachials.—Large scales on the arm.

Bridge.—That portion of the shell of a turtle which attaches the plastron to the carapace.

Canthus rostralis.—A slight continuation of the superciliary ridge separating the top from the side of the snout.

Carapace.—The upper portion of the shell of turtles.

Carinate.—Keeled.

Chin shields.—See geneials.

Cloaca.—A common chamber at the posterior ends of the alimentary and urogenital canals.

Collar.—Gular fold, especially of *Teiidæ.*

Costals.—The large plates on the sides of the carapace.

Dermal.—Pertaining to the skin.

Femoral pores.—Glands along the lower surface of the thigh.

Femorals.—Of turtles, the fifth pair of plastral plates; of lizards, plates on the thigh.

Frenal—See loreal.

Frontal—The large plate or plates on top of the head between the supraoculars. Sometimes applied to the prefrontals.

Frontoparietal.—Plates on top of the head between the parietals and the frontal.

Gastrosteges.—Large plates along the lower surface of the body in most snakes.

Gastrostiga.—See gastrosteges.

Geneials.—Large scales behind the mental of many snakes, often in two pairs—anterior and posterior.

Gular fold.—Transverse fold of skin of throat.

Gular plates.—The first pair of plastral plates.

Gulars.—Scales on throat.

Humerals.—The second pair of plastral plates.

Imbricate.—Lapped, as shingles.

Inferior.—Lower.

Infralabials.—Plates on the lower lip.

Inguinals.—Plates on the posterior surface of the bridge of turtles.

Internasals.—Scales on the top of the snout just behind the rostral plate.

Interparietal.—A plate on top of the head (of lizards) between the parietals and usually containing the pineal spot.

Juxtaposed.—Placed side by side, not imbricate.

Keel.—A ridge along a scale like the keel on an overturned boat.

Labials.—Plates on the lips; specially, on the upper lip.

Laterals.—Scales on the sides; the costals of turtles.

Loral.—See loreal.

Loreal.—In the space between the preoculars and nasals.

Maculate.—Marked.

Marginals.—The plates around the edge of the carapace.

Mental.—Same as symphyseal, but usually of snakes.

Mucronate.—Provided with a point or spine.

Nuchal plate.—The unpaired marginal plate of turtles on the median line at the front of the carapace.

Occipitals.—Plates behind the parietals. Sometimes applied to the parietals.

Parietals.—In most snakes, the largest and last plates on top of the head; in lizards, plates at the side of the interparietal and behind the frontoparietals.

Pectoral plates.—The third pair of plastral plates.

Plastral.—Pertaining to the plastron.

Plastron.—The lower portion of the shell of turtles.

Postabdominal.—Anal plate.

Postanal.—Behind the anus, especially a pair of large plates in the males of some lizards.

Posterior.—Toward the tail.

Postfrontals.—See prefrontals.

Postgeneials.—The posterior pair of geneials.

Postmentals.—Plates behind the mental. See sublabial and geneial.

Postocular.—Bounding the orbit behind.

Preanal.—In front of the anus.

Preanal pores.—Glands opening in front of the anus.

Prefrontal.—Scales between internasals and frontal. Sometimes applied to the internasals.

Pregeneials.—The anterior pair of geneials.

Prenasal.—Anterior nasal.

Preocular.—Bordering the orbit in front.

Pseudopreocular.—Small plate or plates below the preocular.

Reticulate.—Marked with lines like the meshes of a net.

Rostral.—Plate on the tip of the snout.

Scute.—A scale, especially a large flat one.

Subcaudals.—Urosteges.

Sublabials.—Plates below the infralabials.

Subocular.—Scales between the eye and the supralabials.

Superciliary.—Along the upper, outer edge of the orbit. Sometimes applied to the supraoculars of snakes.

Superior.—Upper.

Supracaudal.—Over the tail; the last pair of marginal plates of turtles, sometimes united.

Supralabials.—Upper labials. Also called superior labials or labials.

Supraocular.—Of snakes, the large scale over the eye; of lizards, the scales over the eye excepting the superciliaries.

Suture.—The line of joining.

Symphysal.—See symphyseal.

Symphyseal.—The scale on the tip of the lower jaw, especially of lizards. See mental.

Symphysial.—See symphyseal.

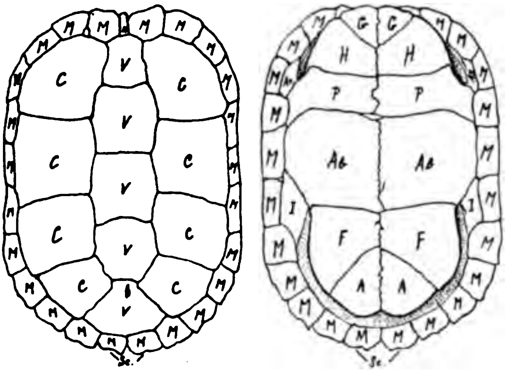
Urosteges.—Large scales on the lower surface of the tail in most snakes.

Vent.—The anus.

Ventrals.—Gastrosteges.

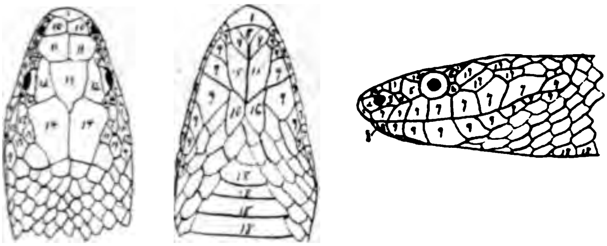
Vertebrals.—The large plates along the middle of the carapace.

Vertical.—Frontal.



A.—Anal
Ab.—Abdominal.
Ax.—Axillary.
C.—Costal.
F.—Femoral.
G.—Gular.
H.—Humerals.

I.—Inguinal.
M.—Marginal.
N.—Nuchal.
P.—Pectoral.
Sc.—Supracaudal.
V.—Vertebral.



1.—Rostral.
2.—Anterior nasal.
3.—Posterior nasal.
4.—Loreal.
5.—Preocular.
6.—Postoculars.
7.—Superior labials.
8.—Mental or symphyseal.
9.—Inferior labials.
10.—Internasals.
11.—Prefrontals.
12.—Supraoculars.
13.—Frontal.
14.—Parietals.
15.—Pregeneials.
16.—Postgeneials.
17.—Temporals.
18.—Gastrosteges.

Class REPTILIA.

The reptiles of the Pacific Coast and Great Basin belong to two great groups, to which they may be referred by the following

SYNOPSIS OF ORDERS.

a.—Body protected by a bony carapace or shell, covered with horny plates or leathery skin, jaws horny, without teeth. (Turtles.) **Testudines.**—p. 28.

a^2.—Body not protected by a bony carapace; jaws provided with teeth.[*] (Lizards and snakes) .... **Squamata.**—p. 28.

Order I. TESTUDINES.

The *Testudinidæ* is, as yet, the only family of turtles known to be represented on the Pacific Coast and in the Great Basin. *Kinosternon* of the *Kinosternidæ*, however, lives in the Gila River of Arizona, and probably will be found in the Colorado as well. A species of *Trionychidæ* has been described[†] as having been taken in the Sacramento River, California. The skull of the type is missing, but in other respects the specimen appears to agree with the descriptions of a Chinese species *(sinensis)*. In view of this, and the additional fact that its describer afterward obtained several specimens of his supposed new species from Chinamen in San Francisco,[‡] I cannot admit "*Pelodiscus californianus*" to be of Californian origin.

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[*] The lower jaw only bears teeth in the *Leptotyphlopidæ*.

[†] See Rivers, Proc. Cal. Ac. Sci. (2), II. 1889. p. 233; Baur, Proc. Am. Philos. Soc., XXXI, 1893, pp. 218, 220.

[‡] Dr. G. Baur has compared the skeleton of one of these specimens with that of *P. sinensis* and writes me that the two do not belong to the same species. Even admitting that the specimen which Rivers sent Dr. Baur is specifically identical with the type, I cannot admit that this turtle is indigenous to California until less questionable evidence of its occurrence here has been obtained.

Family I. TESTUDINIDÆ.

This widely distributed family contains a large number of turtles distinguished from others chiefly by osteological characters. The shell is firmly ossified, and covered with large horny plates of which eleven or twelve are on the plastron. The pectoral plates are in contact with the marginals. The latter are twenty-four or twenty-five in number. The neck can be completely drawn into the shell. Three genera are represented in the area under consideration.

SYNOPSIS OF GENERA.

a.—Feet not club-shaped, webbed; two supracaudal plates; skin on top of head not divided into scales.

b.—Suture between abdominal plates less than twice length of suture between pectorals; inguinal plates not wedged in between abdominals and marginals..............Clemmys.—p. 29.

b².—Suture between abdominal plates about twice length of suture between pectorals; inguinal plates wedged in between abdominals and marginals......................Chrysemys.—p. 32.

a².—Feet club-shaped, not webbed; one supracaudal plate; skin on top of head divided into scales.....................Gopherus.—p. 35.

Genus I. CLEMMYS.

"*Clemmys*, WAGLER, Syst. Amph., 1830, p. 136 (type **caspica**);" "*Chelopus*, RAFIN., Atlant. Journ., 1832, p. 64;" "*Nanemys*, AGASSIZ, Contr. Nat. Hist. U.S., I, 1857, p. 442" (type **guttata**); "*Calemys*, AGASSIZ, l. c., p. 443" (type **muhlenbergii**); "*Glyptemys*, AGASSIZ, l. c., p. 443" (type **insculpta**); *Actinemys*, AGASSIZ, l. c., p. 444 (type **marmorata**); "*Mauremys*, GRAY, Proc. Zool. Soc. Lond., 1869, p. 500" (type **fuliginosa**); "*Sacalia*, GRAY, Suppl. Cat. Sh. Rept. Brit. Mus., 1870, p. 35;" "*Emmenia*, GRAY, l. c., p. 38;" "*Eryma*, GRAY, l. c., p. 44."

The shell is broad and low. The plastron is immovably united to the carapace by a broad bridge. There is no median ridge on the alveolar surface of the upper jaw parallel to the cutting edge. The internal openings of the nostrils are between the eyes. The fingers and toes are webbed. The skin on top of the head is not divided into scales. There are two supracaudal plates. The tail is moderate or long.

1.—**Clemmys marmorata** (Baird & Girard). PACIFIC TERRAPIN.

Emys marmorata, B. & G., Proc. Ac. Nat. Sci. Phila., 1852, p. 177 (type locality **Puget Sound**).

Emys nigra, HALLOW., Proc. Ac. Nat. Sci. Phila., 1854, p. 91 (type locality **Posa Creek, Lower [=Southern] California**); HALLOW., U. S. Pac. R. R. Surv., X, 1859, Pt. IV, p. 3, pl. I.

Actinemys marmorata AGASSIZ, Contr. Nat. Hist. U. S., I, 1857, p. 444, II, pl. III, figs. 5-8; GIRARD, U. S. Explor. Exped., Herp., 1858, p. 465, pl. XXXII.

Clemmys marmorata STRAUCH, Mem. Ac. St. Petersb. (7), V, No. 7, 1862, p. 108; BOULENGER, Cat. Chelonians Brit. Mus., 1889, p. 110; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 162.

Clemmys Wosnessenskyi, STRAUCH, Mem. Ac. St. Petersb. (7), V, No. 7, 1862, p. 114, pl.—— (type locality **Sacramento River, California**).

Geoclemys marmorata, GRAY, Suppl. Cat. Shield Rept. Brit. Mus., 1870, p. 27.

Chelopus marmoratus, COPE. Bull. U. S. Nat. Mus., No. 1, 1875, p. 53; YARROW, Bull. U. S. Nat. Mus., No. 24, 1882, p. 36.

Description.—Shell broad and low, broader posteriorly than anteriorly, more nearly round in young than in adults. Young with a median dorsal ridge not present in adults. Vertebrals five, broader than long. Costals four, first longest, second highest, last smallest. Nuchal very narrow. Marginals twelve on each side, supracaudals being distinct. Plastron large, extending forward about as far as carapace, weakly notched posteriorly, truncate anteriorly. Its gular plates smallest, triangular. Pectorals not much smaller than abdominals. Anals large, median suture between them longer than that of any other plastral plates. Bridge formed of pectoral and abdominal plates. Axillary and inguinal plates very small or absent. Head large, more or less flat topped, covered above and laterally with smooth skin. Upper jaw not hooked, sometimes notched at symphysis. Skin of neck and gular region granular. Limbs covered with scales; anterior with five, posterior with four, digits webbed to bases of long claws. Tail moderately long, tapering to tip, covered with scales in irregular whorls.

The coloration is very variable. In some specimens the carapace is olive or horn-color with few or no markings. In others a few broken and very irregular black lines are present. These lines frequently have become so numerous that, blending and crossing, they appear as the ground color, or form a very fine network through which the original ground color shows more or less indistinctly. Sometimes the carapace is almost black. The plastron is yellow, usually irregularly blotched with black or brown, or with dark lines along the posterior margins of the plates. The upper surface of the head may be unicolor or finely or coarsely reticulated with yellow and black. The chin and throat are yellow, often dotted with brown or black. The limbs and tail are yellow marked with black or brown, or brown marked with yellow. In young, the plates of the carapace show a central area of brown sometimes surrounded by a band of lighter brown or dull yellow, and the markings on the limbs, tail, neck, and gular region form irregular longitudinal bands.

Length of carapace................	27	45	90	120	125	164
Length of plastron................	24	40	79	109	117	153
Width of carapace................	27	42	71	101	100	130
Width of plastron................	21	33	57	85	85	105
Length of tail................	21	30	36	38	48	65

Distribution.—The Pacific Terrapin probably occurs in all the fresh waters of the Pacific Slope from Lower

California to British Columbia. It has been taken at both San Diego and Puget Sound, as well as at many intermediate localities, some of which are: Mojave River,* Posa Creek, South fork of Kern River near Kernville, Mt. Diablo, Monterey, Santa Cruz, Penitentia Creek, Coyote Creek, Palo Alto, San Francisquito Creek, Los Gatos, San Francisco, San Rafael, Sonoma, Nicasio, Sacramento River, McCloud River, Pitt River, California; Klamath Falls, Oregon; Fort Steilacoom, Washington.

Habits.—This is the terrapin of the San Francisco markets, and is popularly known as the Mud Turtle or Snapper. Very little is known of its habits. It is almost exclusively aquatic, preferring ponds and small lakes to running water, but is sometimes encountered on land while crossing from one body of water to another. It is sometimes caught with hook and line, and probably is omnivorous. A specimen which I kept alive laid three eggs in June and another in August. The eggs are elliptical, with hard, white, limy shells, and measure about thirty-four by twenty-one millimetres.

Genus 2. CHRYSEMYS.

Chrysemys, GRAY, Cat. Tort., Croc., Amphis., Brit. Mus., 1844, p. 27 (types **picta** and **bellii**).

The shell is rather narrow, low or moderately high. The plastron is immovably united to the carapace by a broad bridge. There is a ridge on the alveolar surface of the upper jaw parallel to the cutting edge. The internal openings of the nostrils are between the eyes. The fingers and toes are fully webbed. The skin on top of the head is not divided into scales. There are two supracaudal plates. The tail is short or moderate.

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*Cooper, Proc. Cal. Ac. Sci., II, 1863, p. 121.

2.—**Chrysemys bellii** Gray. WESTERN PAINTED TURTLE.

Emys Bellii, GRAY, Syn. Rept. Griffith's An. Kingd., 1831, p. 31 (type locality America?); DUM. & BIBR., Erpét. Générale, II, 1835, p. 302; GRAY, Cat. Tort. Croc. Amphis. Brit. Mus., 1844, p. 27.

Emys Oregoniensis, HARLAN, Am. Journ. Sci. Arts, XXXI, 1837, p. 382, pl. —— (type locality ponds near Columbia River); HOLBROOK, N. A. Herp., I, 1842, p. 107, pl. XVI.

Chrysemys bellii, GRAY, Cat. Shield Rept., I, 1855, p. 33; AGASSIZ, Contr. Nat. Hist. U. S., 1857, I, p. 439, II, pl. VI, figs. 8, 9.

Chrysemys oregonensis, AGASSIZ, Contr. Nat. Hist. U. S., 1857, I, p. 440, II, pl. III, figs. 1-3.

Chrysemys nuttalii, AGASSIZ, Contr. Nat. Hist. U. S., 1857, II, p. 642 (new name for *C. oregonensis*).

Clemmys oregoniensis, STRAUCH, Mem. Ac. St. Petersb. (7), V, No. 7, 1862, p. 114.

Chrysemys cinerea var. *bellii*, BOULENGER, Cat. Chelonians Brit. Mus., 1889, p. 74.

Description.—Shell comparatively narrow, depressed but not very low, without dorsal keel. Vertebrals five, usually longer than broad. Costals four, first longest, second highest, last smallest. Nuchal very narrow. Marginals twelve on each side, supracaudals being distinct. Plastron large, extending forward about as far as carapace, weakly notched posteriorly, truncate or rounded anteriorly. Gular plates smallest, triangular. Pectorals very much smaller than abdominals; latter longest, and with longest median suture. Axillary and inguinal plates well developed, inguinal wedged in between abdominal and marginals. Head moderately large, covered above and laterally, except sometimes on temples, with smooth skin. Upper jaw not hooked, sometimes notched at symphysis. Skin of neck and gular regions granular or tubercular. Limbs covered with scales, anterior with five, posterior with four, digits webbed to bases of long claws. Tail moderately long or short. (Figure, p. 26.)

The carapace is indefinitely marbled above with olive, yellow, and dark brown. Near the middle of each costal plate is a vertical bar of yellow, while a narrow or indistinct yellow line runs along near the anterior margin of each costal plate. In front of each of these yellow markings is a large vertical blotch of dark brown. The vertebrals show traces of yellow longitudinal lines near their lateral edges. The edge of the carapace is yellow; from it yellow bars run up on the middles of the marginal plates. Between these yellow bars are dark brown or black ocelli with indefinite yellow concentric lines. The lower surfaces of the marginals are blotched with dark brown. The plastron is yellow, often heavily blotched with dark brown. The head and limbs are grayish or brownish olive, with numerous longitudinal yellow lines. There is a large, elongate, yellow or orange blotch behind the eye.

The colors of a living specimen were as follows: Large postocular blotch, scarlet-vermilion or flame scarlet; lines on side of head greenish white; lines on top of head dull yellow; eye Paris green with black cross-bar; costal and marginal markings chrome yellow and dark seal brown (almost black); costal bars tinged with cadmium orange.

Length of carapace	250
Length of plastron	232
Width of carapace	175
Width of plastron	139
Length of tail	32

Distribution.— Boulenger records specimens of this turtle as having been collected in British Columbia and at Walla Walla, "British Columbia" [=Washington?]. Harlan's "*Emys Oregoniensis*" was secured in ponds near the Columbia River. This turtle has twice been found in the San Francisco markets. In each instance the market-men told me that the turtle had been sent in with fish from the San Joaquin River near Stockton, California, but, when questioned, could not state positively that the lot had not come from Oregon or Washington.

Genus 3. GOPHERUS.

Xerobates, AGASSIZ, Contr. Nat. Hist. U. S., I, 1857, p. 446 (types **polyphemus** and **berlandieri**).

The shell is very broad and high. The plastron is immovably united to the carapace by a broad bridge. There is a ridge along the middle of the alveolar surface of each side of the upper jaw parallel to the cutting edge, except in front, where there is a longitudinal ridge at the symphysis. The internal openings of the nostrils are between the eyes. The limbs are club-shaped, the fore limbs flattened, without webs. The skin on top of the head is divided into scales. There is but one supracaudal plate.

3.—**Gopherus agassizii** (Cooper). DESERT TORTOISE.

Xerobates agassizii, COOPER, Proc. Cal. Ac. Sci., II, 1863, p. 120 (type locality **Mountains of California near Fort Mojave**); TRUE, Proc. U. S. Nat. Mus., IV, 1881, p. 437.

Testudo agassizii, BOULENGER, Cat. Chelonians Brit. Mus., 1889, p. 156.

Gopherus agassizii, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 161.

Description.—Shell broad and deep, often flattened above, its margin serrate all around, except in worn specimens, and usually more or less rolled upward over limbs. Growth-center of each plate smooth, but usually surrounded by beautifully ribbed shell. Vertebrals five, last largest and widest. Costals four, first longest, second and third about equally high, last smallest. Nuchal not much narrower than long. Marginals eleven and a half on each side, last pair being united to form a single supracaudal plate. Plastron large, extending forward beyond the carapace, notched posteriorly and sometimes anteriorly. Gular plates smallest, sometimes united, covering a narrow process of the plastron, which may be level or curved upward. Pectorals very much smaller than abdominals, with shortest median suture, except sometimes that of anals. Abdominals largest, with longest median suture. Humerals larger than femorals. Anals little longer than gulars. Axillary and inguinal plates well developed, latter varying from two to six, not extensively wedged in between abdominals and marginals. Head rather elongate, not very wide, covered above with flat scales larger anteriorly than posteriorly. Upper jaw not hooked, margins nearly straight, irregularly but finely serrate. Skin of neck with flattened granules. Anterior limbs large, heavy, much expanded laterally, covered in front and externally with large, hard, smooth scales, and provided with five stout claws.* Posterior limbs not compressed, covered around the edge of the circular sole with large scales, and provided with four stout claws. Tail very short, slender distally.

The carapace is brown or horn-color, usually relieved, especially near the centers of the plates, with yellow. The head and limbs are brown. The plastron is yellow, shaded with brown along the edges of its plates.

Length of carapace	215	260	285	310
Length of plastron	210	265	285	300
Width of carapace	160	212	230	240
Width of plastron	148	184	210	209

Distribution.—The Desert Tortoise is known only from the desert portions of southeastern California, southern Nevada, and probably Arizona.† It has been recorded from Yuma, Solado Valley, Leach Point Valley, Mountains near Fort Mojave, between Daggett and Pilot Knob, California; from Pahrump Valley and the Bend of the Colorado River, Nevada; and from Tucson, Arizona.* It occurs also at Needles and at Crater Summit, California.

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* In one specimen the outer three claws of the right foot are united.

† Cox, Am. Nat., XV, 1881, p. 1003.

Habits.—Almost nothing is known of the habits of this turtle if we except the following note by Mr. E. T. Cox:*

"This fellow is found on the basaltic mountains in the most arid parts of this dry country. He is a vegetarian, feeding, as I am told, on cacti. His flesh is highly esteemed as food by the Indians and Mexicans. You will perceive that his mandibles are notched or toothed. His legs are covered with bony scales, and his front toe nails are made long and strong for digging amongst the rocks, while the hind feet are round like an elephant's.

"When molested he draws in his head and closes the aperture with his legs by bringing the knees together in front of the head; the hind legs are also drawn in until the posterior spaces are closed by the feet, and in this way all vulnerable points are protected by impenetrable armor. In preparing the specimen, I found on each side, between the flesh and carapax, a large membranous sack filled with clear water; I judged that about a pint run out, though the animal had been some days in captivity and without water before coming into my possession. Here then is the secret of his living in such a dry region; he carries his supply of water in two tanks. The thirsty traveler, falling in with one of these tortoises and aware of this fact, need have no fear of dying for immediate want of water."

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* Cox, l. c.

Order II. SQUAMATA.

The order *Squamata* contains the lizards and the snakes, which are regarded as constituting two suborders—*Sauri* and *Serpentes*. These suborders are very closely allied, and for convenience are treated together in the following

SYNOPSIS OF FAMILIES.

- a.—Limbs well developed, pentadactyle.
  - b.—Eye with movable lids.
    - c.—Pupil elliptical, vertical; skin of top of head soft, free from skull, and covered with minute granules which are not appreciably larger than those on the back. **Eublepharidæ.**—p. 39.
    - c^2.—Pupil round; top of head with plates or scales, not movable.
      - d.—A series of femoral pores.
        - e.—Lateral scales not abruptly smaller than ventrals; ventrals in numerous series; tongue not deeply divided at tip. **Iguanidæ.**—p. 42.
        - e^2.—Lateral scales granular like dorsals, abruptly smaller than ventrals; ventrals in eight longitudinal series; tongue ending in two long slender points. **Teiidæ.**—p. 132.
      - d^2.—No femoral pores.
        - f.—Lateral scales very much smaller than dorsals and ventrals, usually hidden by a lateral fold; dorsal scales keeled. **Anguidæ.**—p. 101.
        - f^2.—Lateral scales not much smaller than dorsals and ventrals; no lateral fold; scales smooth.
          - g.—Scales on body flat, thin, and imbricate. **Scincidæ.**—p. 143.
          - g^2.—Scales on body wart-like tubercles, usually bony, separated by narrow granular spaces. **Helodermatidæ.**—p. 120.
  - b^2.—Eye without lids; pupil elliptical..... **Xantusiidæ.**—p. 122.
- a^2.—Limbs absent (or rudimentary in *Boidæ*).
  - h.—Ventral scales less than twice as broad as dorsals.
    - i.—Plates on top of head much larger than those on body; anus bordered in front by several scales; no spine at end of tail. **Anniellidæ.**—p. 115.
    - i^2.—Plates on top of head not larger than those on body; anus bordered in front by a single plate; a small spine at end of tail.......................... **Leptotyphlopidæ.**—p. 150.

h².—Ventral plates more than twice as broad as dorsal scales.
j.—No rattle at end of tail; no pit between nostril and eye.
k.—A small spur at each side of the anus; tail short and truncate, or top of head with small scales; pupil vertical.
Boidæ.—p. 152.
k².—No spur at side of anus; tail tapering; top of head with large plates; pupil round or elliptical.
No enlarged fangs at front of mouth; coloration, if in rings, not red separated from black by white (yellow).
Colubridæ.—p. 157.
j².—A horny rattle at end of tail; a pit between nostril and eye; a pair of large erectile fangs............Crotalidæ.—p. 214.

Suborder I. SAURI—Lizards.

Family II. EUBLEPHARIDÆ.

The members of this family are most closely related to the *Geckonidæ* or true geckos from which they are distinguished by the procœlian vertebræ and united parietal bones. The clavicle is dilated and loop-shaped proximally. The limbs are slender and the claws wholly or partially retractile into a sheath composed of two lateral plates whose superior edges are covered by a third. The eyes are rather large, with movable lids, and vertically elongate pupil.

Genus 4. COLEONYX.

Coleonyx, GRAY, Ann. & Mag. Nat. Hist., XVI, 1845, p. 162 (type **elegans**); "*Brachydactylus*, PETERS, Mon. Berl. Ac., 1863, p. 41" (type **mitratus**).

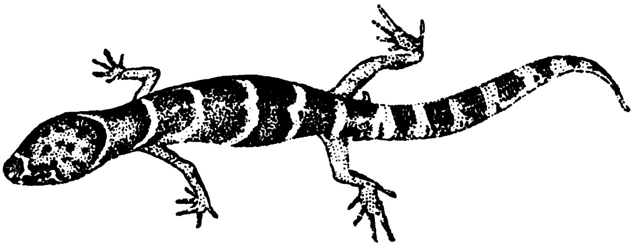
In this genus the lower surface of each digit is provided with a series of small transverse plates. There are no enlarged chin shields behind the symphyseal plate. The skin is very soft, finely granular, and not attached to the bones of the skull. A small ear-opening is present. Males have a few preanal pores.

4.—**Coleonyx variegatus** (Baird). BANDED GECKO.

Stenodactylus variegatus, BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, p. 254 (type locality Colorado Desert); *and* Mex. Bound Surv. Rept., II, pl. XXIII, figs. 9-27.

Eublepharis fasciatus, BOULENGER, Cat. Liz. Brit. Mus., 1885, I, p. 234 (type locality Ventanas, Mexico).

Description.—Snout narrow but rounded and a little longer than distance between orbit and ear-opening. Head and upper surfaces of body covered with minute granules slightly larger on snout than elsewhere. Rostral plate somewhat broader than high, and presenting five edges. Behind it the slender prenasals, meeting on the median line. A small supranasal plate. Symphyseal large, longer than wide. Six to eight upper and as many lower labials, decreasing in size posteriorly. Eyelids bearing a fringe of pointed scales. Ear-opening small, oval, and oblique. Feet, belly, and tail covered with small, smooth, imbricate scales. Digits short. Tail conical, about as long as head and body. A small spur on each side of tail near its base. Males with a short series of six to eight preanal pores.



The back is crossed by about five broad bands of dull brown between which are narrower wavy bands of white. A white horseshoe-shaped line on the neck passes just above the ears and ends near the eyes. The head is brown, or whitish with irregular brown spots. A dark brown band runs from the eye to the nostril. The labials are spotted with brown and white. The tail is cross-barred with the colors of the back, but the white areas are often partly occupied by brown spots. One specimen has the brown bands of the back narrower than the white ones. The lower surfaces are white.

A living specimen of *Coleonyx variegatus* is colored as follows: Across the back are five wide bands of dark walnut brown, palest centrally, and separated from one another by dull Naples yellow bands of about half their width. The tail is similarly cross-banded. The upper surfaces of the head and limbs are fawn color, the limbs being faintly and the head strongly marked with small irregular spots of walnut brown. The edges of the eyelids are white. A white line runs back from the eye to the top of the neck, where it meets or almost meets its fellow of the opposite side. A walnut line, bordered above and below with white, connects the eye and nostril. The tongue is rich pink with a bright red tip. The lower surfaces are white. The eye is pale grayish yellow with a network of fine black lines.

Length to anus	32	57	61	65
Snout to orbit	3	5	5	6
Snout to ear	8	13	13	14
Orbit to ear	3	5	5	6
Fore limb	12	19	22	23
Hind limb	16	27	28	28
Base of fifth to end of fourth toe	4	6	7	8

Distribution.—The Banded Gecko probably ranges over the greater part of the Mojave and Colorado Deserts of southeastern California. In the north, it has been taken in Owen's and Death Valleys in Inyo County; in the west, at Mojave in Kern County and San Jacinto in Riverside County; and in the southeast, at Fort Yuma in San Diego County. Thence its range extends east to Tucson, Arizona, and south into Mexico.

Habits.—Very little is known of the habits of this lizard. An individual kept in confinement for more than a year spent most of his time in a hole provided in the ground of his cage. His food during this period consisted entirely of houseflies. His usual time of feeding was after dark, but not infrequently he would snap up a fly which chanced to stray into the mouth of his burrow during the day, and sometimes would come forth in search of prey while the sun was shining brightly on his den. When stalking flies, his movements were so slow as almost to be imperceptible until he was within range and could seize the coveted morsel with one instantaneous snap. If blown upon, he would raise himself and stand with legs straight and rigid. When first sent to me, this lizard had the skin of the occiput raised into a large hood, but whether this was a nuptial ornament or due to some accident I cannot tell.

Family III. IGUANIDÆ.

The members of this family present, in their strange diversity of form, a series of pleurodont lizards which closely parallels in the New World the acrodont *Agamidæ* of the Old. The *Iguanidæ* are diurnal lizards having eyes with round pupils and well developed lids. The tongue is short, thick, and but slightly notched anteriorly. Femoral pores are present in North American species. The clavicle is not dilated, except in the Central American *Basiliscinæ*. Some species of *Sceloporus* and *Phrynosoma* are said to be ovoviviparous. Californian Iguanians may be distinguished by the following

SYNOPSIS OF GENERA.

a.—A low dorsal crest composed of one longitudinal series of enlarged scales.................................... **Dipsosaurus.**—p. 43.
a^2.—No dorsal crest.
  b.—Head without spines.
    c.—One or more well developed transverse gular folds.
      d.—Toes fringed laterally with prominent movable spines. **Uma.**—p. 46.
      d^2.—Toes without spines.
        e.—Supralabials strongly imbricate; symphyseal plate smaller than largest infralabial.
          f.—An ear-opening..................... **Callisaurus.**—p. 47.
          f^2.—No ear-opening.................... **Holbrookia.**—p. 51.
        e^2.—Supralabials not imbricate; symphyseal plate not smaller than largest infralabial.
          g.—No large interparietal plate; caudal scales small, not strongly keeled nor sharply pointed.
            h.—Ear without strong denticulation and neck without spinose tubercles; superciliaries imbricate; tail long and tapering.................. **Crotaphytus.**—p. 53.
            h^2.—Ear with strong denticulation and neck with numerous spinose tubercles on lateral folds; superciliaries not imbricate; tail scarcely longer than distance from snout to vent................... **Sauromalus.**—p. 60.
          g^2.—A very large interparietal plate; caudal scales large, strongly keeled, and sharply pointed. **Uta.**—p. 63.
    c^2.—No complete transverse gular fold......... **Sceloporus.**—p. 73.
  b^2.—Head with large spines posteriorly.......... **Phrynosoma.**—p. 89.

Genus 5. DIPSOSAURUS.

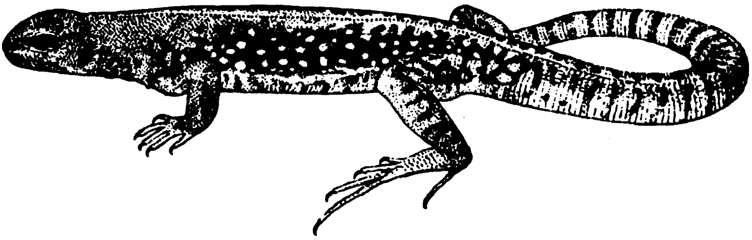
Dipsosaurus, HALLOW., Proc. Ac. Nat. Sci. Phila., 1854, p. 92 (type **dorsalis**).

The scales of the median dorsal row are slightly enlarged, forming a small crest. The head is covered with small convex subgranular plates. The dorsal and caudal scales are small. There is one strong transverse gular fold. Femoral pores are numerous. Males do not have enlarged postanal plates. Digits each have a series of keeled plates below.

5. **Dipsosaurus dorsalis** (Baird & Girard). CRESTED LIZARD.

Crotaphytus dorsalis, BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, p. 126 (type locality **Desert of Colorado, Cal.**).
Dipsosaurus dorsalis, BAIRD, U. S. Mex. Bound. Surv., III, Rept., pl. XXXII, figs. 7-13.

Description.—Head short, rounded, and rather high. Nostril opening laterally in a single rounded plate which is separated from the large rostral by one or two rows of granules. Supraocular regions separated from each other by two or three series of small convex plates and covered with very small plates and granules. A large subocular, followed and preceded by several smaller ones. A series of long, strongly imbricate superciliaries. Labials small, about equal in size, and from eight to eleven in number in each series. Symphyseal plate nearly triangular and forming the base of a V-shaped series of slightly enlarged plates. Gulars small, either convex or flattened. Eyelids very slightly fringed. Ear-opening very large, almost vertical, and with a very weak anterior denticulation. Dorsal crest composed of slightly enlarged, strongly keeled scales. Other dorsals small, keeled, juxtaposed, and in series which converge toward the dorsal line posteriorly. Ventrals larger than dorsals and caudals, smooth and imbricate. Sides covered with small granular scales. Tail long, tapering, slightly crested, and with whorls of



obliquely keeled scales. Limbs rather long, covered with keeled scales and granules. Femoral pores varying from sixteen to twenty-five in number.

The general color is grayish brown above, variously barred and reticulated with dark brown and slate, and spotted or blotched with light gray or white. These markings are often less distinct near the vertebral line than laterally. The upper surface of the head is grayish, brownish, or yellowish, more or less clouded with slate, darkest on the supraocular regions. The tail is whitish, yellowish, grayish, or brownish, marked with rings of brown or slate. The lower surfaces are white, marked on the chin and gular region with longitudinal or oblique lines of brown or bluish gray.

The following color description was taken from a fresh male shot at Yuma, Arizona, October 1, 1894: The head is creamy, tinged on the sides with vinaceous and on the supraocular regions with black; below, white with indistinct gray markings. The back is cream with numerous transverse gray bars and more or less broken longitudinal lines of dull Chinese orange. These lines become spots on the sides. The tail is half-ringed with more or less connected spots of the same orange color. The belly is white with a large patch of reddish orange on each side.

Length to anus	47	73	94	105	126	133
Length of tail	91	151	172	190	232	255
Snout to orbit	4	5	6	7	8	9
Snout to ear	10	15	18	19	21	23
Orbit to ear	3	4	5	6	6	7
Fore limb	20	29	38	40	43	54
Hind limb	37	55	68	77	81	95
Base of fifth to end of fourth toe	17	24	29	32	34	39

Distribution.—In California, the Crested Lizard ranges over the lower levels of the Colorado and Mojave Deserts, pushing its way north to Owen's, Panamint, Death, and Amargosa Valleys. West of the desert region it has not been found and doubtless does not occur. It is quite common at Yuma. In Nevada, it has been taken on the Amargosa Desert and at Callville on the Great Bend of the Colorado River.

Habits.—At Yuma, this lizard lives in burrows in the mounds of sand which the winds heap up around the cactus bunches; the spines of the cactus serving to protect them from the quick swoops of hungry hawks and the digging of larger enemies. Dr. C. Hart Merriam says:* "It is a strict vegetarian, feeding on buds and flowers, which it devours in large quantities. No insects were found in any of the stomachs examined; some contained beautiful bouquets of the yellow blossoms of acacia, the orange malvastrum, the rich purple Dalea, and the mesquite *(Prosopis juliflora)*; others contained leaves only."

Genus 6. UMA.

Uma, BAIRD, Proc. Ac. Nat. Sci. Phila., 1858, p. 253 (type **notata**).

"A series of elongate free scales on each side of the digits, and on the external side of the sole." "Ears distinct. A very long infraorbital plate. Palate without teeth. Outer face of upper labials plane and broadly vertical; the labials themselves much imbricated, and very oblique. Scales of body above equal, much smaller than ventral ones. Interorbital space with two series of plates. Claws very long, slender and straight."

SYNOPSIS OF SPECIES.

a.—Nine rows of loreal plates; black spots on side of belly.
U. notata.—p. 47.
a².—Five or six rows of loreal plates; no black spots on side of belly.
U. inornata.—p. 47.

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* N. A. Fauna No. 7, 1893, p. 165.

6.—Uma notata Baird. SAND LIZARD.

Uma notata, BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, p. 253 (type locality **Mojave Desert**); COPE, Am. Nat., 1895, p. 939.

Description.—" Labial scales weakly keeled; nine loreal rows; fourteen supraorbital rows; hind foot longer, two-fifths head and body; femoral pores nineteen. Black spots on side of belly but no crescents on throat." " Head about two-fifths the head and body. Above light pea green, spotted with darker green. Beneath white."

Distribution.—Mojave Desert.

Habits.—Unknown.

7.—Uma inornata Cope. PLAIN SAND LIZARD.

Uma inornata COPE, Am. Nat. 1895, p. 939 (type locality **Colorado Desert, San Diego Co., Cal.**).

Description.—" Labial scales strongly keeled; five or six loreal rows; ten or eleven supraocular rows; hindfoot shorter, one-third head and body; femoral pores nineteen. No black spots on belly or crescents on throat."

I do not feel certain that these two supposed species are really distinct. The slight differential characters which have been pointed out are manifestly rather variable, and each name is based upon a single specimen, at least one of which *(U. notata)* is young and in a very poor state of preservation.

Distribution.—" Colorado Desert, San Diego County, California."

Genus 7. CALLISAURUS.

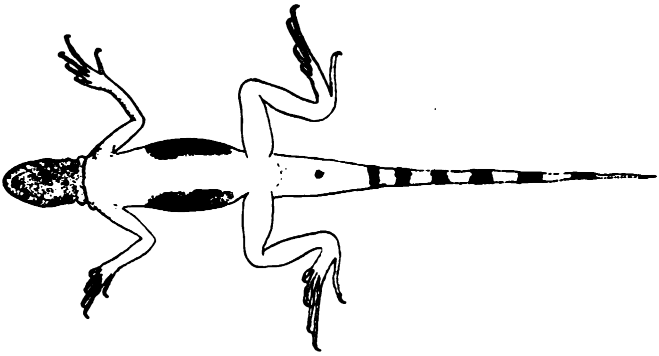
Callisaurus BLAINV., Nouv. Ann. Mus., IV, 1835, p. 286 (type **draconoides**); *Megadactylus* FITZINGER, Syst. Rept., 1843, p. 59 (type **draconoides**); *Homalosaurus* HALLOW., Proc. Ac. Nat. Sci. Phila., 1852, p. 179 (type **ventralis**).

The lizards of this genus have the body and tail considerably flattened, legs very long, and the head rounded when seen from above but pointed in profile. The head is covered with irregular plates, the largest of which is the interparietal. The labials are produced laterally and are strongly imbricate. The ear-opening is large. The dorsal scales are very small and nearly uniform. There are no fringes of movable scales on the digits. Long series of femoral pores are present. There are two or more transverse gular folds. Males have enlarged postanal plates.

8.—**Callisaurus ventralis** (Hallowell). GRIDIRON-TAILED LIZARD.

Homalosaurus ventralis HALLOW., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 179 (type locality **New Mexico**); and Sitgr. Zuni & Colorado Rivers, 1853, p. 117, pl. 6.

Description.—Head rather short and low, with well developed canthus rostralis. Nostrils large, opening on upper surface of snout. Supraocular regions covered with small plates and separated from each other by one or two rows of slightly larger plates. Upper head plates (except interparietal) small and irregular, largest on frontal and prefrontal regions, everywhere smooth and flat. Several subocular plates, middle one very long and strongly keeled. Superciliaries rather small, but strongly



imbricate. Eyelids bearing a well developed fringe. Supralabials strongly imbricate and produced laterally so as to form a series of curves when seen from above. Infralabials small and juxtaposed. Below them, several series of flat sublabial plates. Gulars granular and smooth, growing larger and imbricate on posterior fold. Back and sides covered with small flattened granules, which change gradually into much larger smooth ventrals. A dermal fold usually extending along each side between limbs. Tail of moderate length, much flattened. Its scales slightly imbricate, and along its edge, pointed. Limbs very long and slender. Ear-opening large, without denticulation. Femoral pores varying from fourteen to eighteen.

The general color above is grayish, dotted and spotted with white or pale gray, and with indications of dark dorsal blotches which are most distinct in females and young. The top of the head is rich cream, clouded with dark slaty gray. The upper surfaces of the limbs and tail are crossed by more or less undulating bands of dark brown or blackish slate. A dark line, bordered above and below with white, runs along the back of the thigh. The throat is white, more or less clouded with gray. The lower surface of the tail is white with about seven cross-bars of intense black. The belly is whitish. Males have a large blue patch, marked with two oblique wedge-shaped black blotches, on each side.

The following color description was taken from a fresh male shot at Yuma, Arizona, October 1, 1894: The top of the head is cream; the upper surface of the fore limbs bright lemon yellow; the hind limbs slightly tinged with yellow; neck and fore back pale gray spotted with lighter; back like neck, but suffused with bright lemon yellow, which extends down over the sides and changes to orange near the large verdigris green blotches on the sides of the belly. There is a reddish orange area in front of each of these green blotches. The throat is gray with a half-concealed vermilion spot.

Length to anus	44	72	74	82	86	88
Length of tail	59	102	98	107	117	
Snout to back of interparietal	9	13	13	14	15	15
Snout to ear	10	15	14	16	16	16
Width of head	9	13	13	14	14	14
Fore limb	24	42	41	45	49	46
Hind limb	41	70	65	76	79	
Base of fifth to end of fourth toe	17	31	30	33	35	

Distribution.—The range of the Gridiron-tailed Lizard in California is, in general, the whole southeastern part of the state comprised in the Mojave and Colorado Deserts. In the north, it extends to Owen's, Saline, and Death Valleys, in Inyo County; in the west, to the lower parts of Antelope Valley in Los Angeles County, and the top of San Gorgonio Pass near Banning, Riverside County. The species has been found also at Fish Springs and in a little 'island' of the desert at Oak Grove, San Diego County, and is very abundant along the Colorado River. "Southern and western Nevada as far north as Pyramid Lake" are also occupied by it.

Habits.—The Gridiron-tailed Lizard "inhabits the open deserts and runs with great swiftness over the sand and gravel beds, carrying its tail curled over its back as if afraid to let it touch the hot surface of the earth. It starts off at full speed as if fired from a cannon, and stops with equal suddenness, thus escaping or eluding its enemies, the coyotes, hawks, and larger lizards. When running it moves so swiftly that the eye has difficulty in following, and when at rest its colors harmonize so well with those of the desert that it can hardly be seen. This species feeds on insects and the blossoms and leaves of plants in about equal proportion."*

Genus 8. HOLBROOKIA.

Holbrookia, GIRARD, Proc. Am. Assoc. Adv. Sci., IV, 1851, p. 200 (type **maculata**); *Cophosaurus*, TROSCHEL, Arch. f. Nat., 1850 (1852), p. 389 (type **texanus**).

This genus contains a number of lizards similar to *Callisaurus* but with the ears hidden under the skin. The head, rounded when seen from above but pointed in profile, is covered with irregular plates, the largest of which is the interparietal. The labials are produced laterally and are strongly imbricate. There is no ear-opening. The dorsal scales are very small and nearly uniform. There are no fringes of movable spines on the digits. Long series of femoral pores are present, as are one strong and one or more weak gular folds. Males have enlarged postanal plates.

9.—**Holbrookia maculata approximans** (Baird). WESTERN EARLESS LIZARD.

Holbrookia approximans, BAIRD, Proc. Ac. Nat. Sci. Phila., 1858, p. 253 (type locality **Lower Rio Grande**).

Holbrookia maculata maculata, YARROW, Bull. U. S. Nat. Mus., No. 24, 1882, p, 49.

Holbrookia maculata var. *flavilenta*, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 10 (type locality **Lake Valley, New Mexico**); STEJNEGER, N. A. Fauna, No. 3, p. 109.

Description.—Head rather short and low. Nostrils large, opening on upper surface of snout. Supraocular regions covered with small plates or granules and separated from each other by one or two rows of slightly larger plates. Upper head-plates, except interparietal, small and irregular, largest on frontal and prefrontal regions, everywhere smooth and rather flat. Several subocular plates, middle one very long and strongly keeled. Superciliaries rather small, but strongly imbricate. Eyelids with well developed fringe. Supralabials strongly imbricate and produced laterally so as to give snout a rounded outline when seen from above. Infralabials small and juxtaposed. Several series of flat sublabials. Gulars granular and smooth, growing larger and imbricate on posterior fold. Back and sides covered with scales or granules, largest near middle of back and changing gradually to larger smooth ventrals. A dermal fold usually present along each side between limbs. Tail of moderate length, flattened near the body. Its scales feebly keeled and slightly imbricate. Limbs rather long, not very slender, eight to thirteen femoral pores.

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* Merriam, N. A. Fauna, No. 7, 1893, pp. 171, 172.

The color above is gray, yellow, or brown, with two or four series of dark undulate blotches and numerous light spots. The blotches are often more or less obsolete and are most distinct in females and young. The top of the head is colored like the back, but without definite markings. The limbs may be unicolor or crossed by dark bars. The throat is white or yellow, sometimes marbled with dusky. The belly is white or yellow with two or three black bars on the sides usually surrounded with blue. The tail is grayish or brownish above, white or yellow below.

Length to anus	52	53	56	58	64	67
Length of tail	40	58	66	55	56	60
Snout to back of interparietal	9	9	10	10	11	11
Width of head	9	9	9	10	11	11
Fore limb	21	26	29	28	26	30
Hind limb	33	42	44	43	40	45
Base of fifth to end of fourth toe	12	17	17	17	14	17

Distribution.—This *Holbrookia* is very common in Arizona and has been taken at Dome Cañon, Nevada.

Yarrow has recorded a *Holbrookia* as having been collected at Fort Tejon, California, but there is not the slightest probability that this is correct.

Genus 9. CROTAPHYTUS.

Crotaphytus, HOLBROOK, N. A. Herpetology, II, 1842, p. 79 (type **collaris**).

The head and body are somewhat depressed, and much shorter than the tapering tail. All of the head-plates are small. The labials are not imbricate. The ear-opening is large, without strong denticulation. The dorsal scales are small and nearly uniform. Long series of femoral pores and one or more tranverse gular folds are present. There are no spinose tubercles on the neck. The superciliaries are imbricate. Males have enlarged postanal plates.

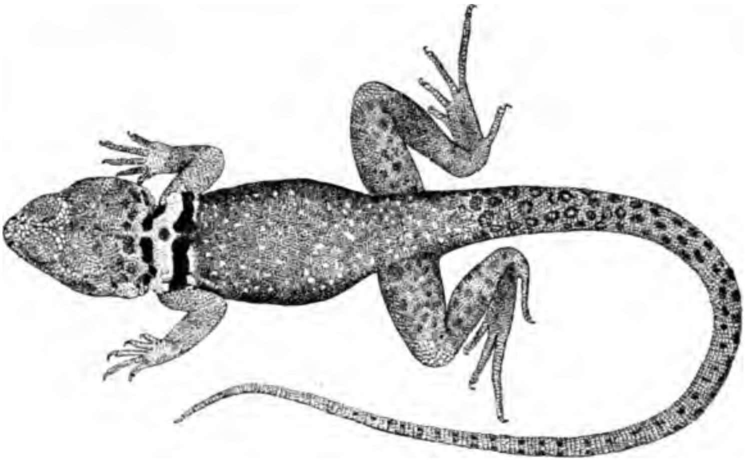
SYNOPSIS OF SPECIES.

a.—Two black bars across the shoulders..........C. baileyi.—p. 53.
a².—No black bars across shoulders.
  b.—Greatest width of head less than distance between nostril and ear-opening.............................. C. wislizenii.—p. 56.
  b².—Greatest width of head equal to or greater than distance between nostril and ear-opening ....C. silus.—p. 59.

10.—**Crotaphytus baileyi** Stejneger. BAILEY'S LIZARD.

Crotaphytus baileyi, STEJN., N. A. Fauna, No. 3, 1890, p. 103, pl. XII, fig. 1 (type locality **Painted Desert, Little Colorado River, Arizona**); and l. c., No. 7, 1893, p. 165.

Description.—Head large, depressed, and very distinct from the neck on account of swollen temples. Its plates all small, but largest and somewhat convex on snout. Two longitudinal rows of shields separating supraocular regions. Nostrils large and opening laterally, each in a round plate nearer to end of snout than to orbit. Superciliaries small but imbricate. Supralabials rather prominent and of nearly equal size. A large subocular plate. Ear-opening large, oblique, with very slight anterior denticulation. Supraoculars, temporals, and gulars subgranular. Lower labials a little larger than upper, bordered below by several series of plates larger than gulars. Symphyseal plate large, followed by a pair of large shields. One or two gular folds, continued on sides of neck. Back and sides covered with small granules, which pass gradually into larger, smooth, flat scales on belly. Sides irregularly plicate. Tail tapering, nearly twice as long as head and body, and furnished with whorls of small, smooth plates. Femoral pores varying in number from sixteen to twenty-two in each series. Males with enlarged postanal plates.



The general color is greenish, bluish, olive, grayish, or pale brown, variously dotted, blotched, reticulated, and cross-lined with pale gray or white. Two parallel oblique bands of intense black or very dark brown cross the shoulders, but often do not meet on the nape. The tail sometimes bears large brown spots. The head is irregularly spotted and reticulated laterally and inferiorly. The throat and belly are white, more or less suffused with blue; the latter sometimes with large brown lateral blotches.

Dr. Stejneger has given* the following description of the fresh colors of a young individual obtained near the Little Colorado River, Arizona:—

"Head above pale sepia, inclining to clay color; anterior portion of upper neck in front of the first black collar pale blue, with several longitudinal marks of 'coral red;' space between the two black collars pale 'oil green,' with a narrow transverse collar of coral red; ground color of back dull oil green, fading posteriorly on hind legs and tail to a grayish 'pea green,' the back densely covered with rather large dark grayish olive blotches, which only allow the ground color to show through as a fine reticulation; the second black collar bordered posteriorly with a wide line of 'lemon yellow,' the back being crossed by five similar lines, fading posteriorly and more or less alternating on the lateral halves of the body; tail with transverse bars of dark grayish brown; fore legs above 'apple green,' nearly yellow on hand and faintly barred with the latter color; under surface pale greenish-white, palms slightly pinkish, tail nearly white. Tongue deep pink; pharynx blackish carmine; palate ultramarine blue. Iris brassy greenish-yellow."

Length to anus	60	82	90	99	100	106
Length of tail	111	173	175	242	210	229
Snout to orbit	5	8	9	9	10	12
Snout to ear	16	23	25	30	29	32
Width of head	14	20	23	25	25	26
Fore limb	27	39	42	50	48	55
Hind limb	54	82	82	98	90	103
Base of fifth to end of fourth toe	20	29	29	33	31	37

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*N. A. Fauna, No. 3, 1890, p. 106.

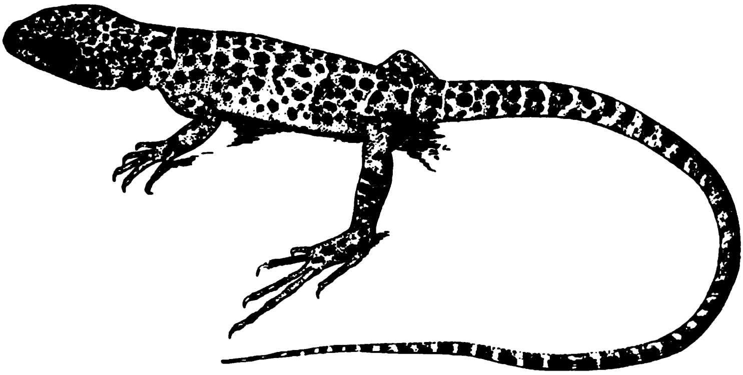
Distribution.—This also is a lizard of the desert, but seems not to live upon its lower levels, preferring the more mountainous portions between the altitudes of about 4,500 and 6,500 feet. In suitable localities it is quite abundant in Inyo, Kern, and San Bernardino Counties, and doubtless occurs also in the eastern parts of Riverside and San Diego Counties, California. It has been recorded from Idaho (mouth of Bruneau River) and is common in western Utah and in most parts of Nevada (Oasis Valley, Juniper Mts., Desert Mts., North Kingston Mts., Reno to Pyramid Lake, Dome Cañon, etc.).

11.—**Crotaphytus wislizenii** Baird & Girard. LEOPARD LIZARD.

Crotaphytus Wislizenii, B. & G., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 69 (type locality **Santa Fé, New Mexico**); *and* Stansbury's Exped. Gt. Salt Lake, 1853, p. 340, pl. III; BAIRD, Mex. Bound. Surv., 1859, pl. XXXI.

Crotaphytus Gambelii, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 126 (type locality **California**).

Description.—Head large, depressed, not so distinct from neck as in *C. baileyi*. Its plates all small but largest and somewhat convex on snout. Three to five longitudinal rows of shields separating supraocular regions. Nostril large and opening laterally in a round plate much nearer to end of snout than to orbit. Superciliaries small but imbricate. Rostral plate wide but very low. Supralabials of nearly equal size. A long subocular plate. Ear-opening large, oblique, with very slight anterior denticulation. Supraoculars and temporals granular, as also gulars. Lower labials slightly larger than upper, and bordered below by several series of small plates, larger than gulars. Symphyseal plate very large, but shields behind it not so large as in *C. baileyi*. From one to three transverse gular folds only one well developed. Back and sides covered with small granules, largest centrally and passing gradually into the larger scales on the belly. Latter imbricate and sometimes keeled. Irregular dermal folds usually present on sides. Tail conical, a little more than twice length of head and body, and covered with whorls of small scales. Femoral pores varying in number from about seventeen to twenty-three. Males with enlarged postanal plates.



In young specimens the head is dark brown above, with cream-colored lines surrounding the orbits and supraocular regions and running up the median line of the snout from the rostral plate. The back is grayish brown with white or cream-colored cross-lines, which may either meet or alternate, on the median line, with those of the opposite side. Between each pair of these cross-lines is a round spot of dark reddish brown. The tail is marked like the back, but not so regularly. The limbs are brown with irregular spots and lines of white. The lower surfaces are yellowish white, marked on the throat with longitudinal lines of dark brown. As the animals become larger the brown dorsal spots become smaller and more numerous, so that there are several between each pair of light cross-lines. The whole coloration becomes paler, as if faded, and the pattern less distinct. Usually the light cross-lines fade first, leaving the spots fairly distinct, but the reverse order of disappearance may occur. In some very old specimens the cross-lines have entirely vanished and the brown spots have become very minute. There is also a good deal of purely individual color variation.

During the breeding season some females have the under surfaces and sides of the tail and body suffused with deep salmon or salmon-red. This color disappears in alcohol.

Length to anus	47	69	87	89	107	119
Length of tail	77	160	175	204	225	
Snout to orbit	4	6	8	8	10	12
Nostril to ear	10	14	18	18	21	25
Width of head	9	12	16	16	19	22
Fore limb	19	28	34	34	43	46
Hind limb	32	54	69	74	80	87
Base of fifth to end of fourth toe	13	21	27	30	30	33

Distribution.—The Leopard Lizard occupies almost the entire desert region of eastern California, ranging from San Diego County across the Colorado and Mojave Deserts to the smaller desert valleys of the Great Basin, where it is quite common in Inyo County. Through Walker Pass, it reaches the western slope of the Sierra Nevada, where it occurs in Kern Valley. It has been collected also at San Jacinto on the western slope of the Coast Range of Riverside County. At Mojave Station, Kern County, this lizard is rather rare, but at Needles, San Bernardino County, it may readily be found on the sand banks of the Colorado River. It ranges across Nevada (Pyramid Lake, Panaca, Vegas Valley, Mt. Magruder, Quartz Spring, Amargosa Desert, Sarcobatus Flat, Charleston Mts., Grapevine Mts., Timpahute Mts., Indian Spring Valley, Pahrump Valley, Pahranagat Valley, Oasis Valley, Wadsworth, Dome Cañon, Truckee River) to Utah (St. George, etc.), Oregon (Dalles), and Idaho (along Snake River).

Habits.—"The leopard lizard is chiefly a vegetarian, feeding on the blossoms and leaves of plants; but is also carnivorous, devouring the smaller lizards, horned toads, and even its own kind, besides large numbers of insects, as determined by the examination of many stomachs."* It usually is sluggish, and may be captured without much difficulty.

12.— **Crotaphytus silus** Stejneger. SHORT-NOSED LEOPARD LIZARD.

Crotaphytus silus, STEJN., N. A. Fauna, No. 3, 1890, p. 105 (type locality **Fresno, Calif.**); *Id.*, *ibid.*, No. 7, 1893, p. 170.

Description.—This species is very similar to *C. wislizenii*, but has a much shorter and more truncate snout. The greatest width of the head is equal to or greater than the distance from the nostril to the ear-opening. The distance between the nostril and the inner anterior orbital angle is considerably less than the vertical diameter of the ear-opening.

"The coloration is also essentially different. In *C. silus* the rounded dorsal spots are larger, especially the two median rows, so that of the latter there is only one longitudinal series between the light cross-bands. The latter are very broad and distinct and do not seem to disappear as the animal grows larger. In some specimens the interspaces between the light bands are solidly dark, the spots indicated only by somewhat ill-defined patches of saturated ferrugineous."

Distribution.—"This species seems to be closely restricted to the San Joaquin Valley, while the typical *C. wislizenii* reaches the west slope of the Sierra Nevada through Walker Pass, the summit of which is only 5,100 feet in altitude and, therefore, not above the vertical range of the species." It probably lives in the Sacramento Valley also, but has not been definitely recorded from that region.

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* N. A. Fauna, No. 7, 1893, p. 168.

Genus 10. SAUROMALUS.

Sauromalus, Duméril, Arch. Mus. d'Hist. Nat., VIII, 1856, p. 535, (type **ater**); *Euphryne*, Baird, Proc. Ac. Nat. Sci. Phila., 1858, p. 253 (type **obesus**).

The head and body are much depressed, and but little shorter than the heavy conical tail. All of the head-plates are small. The labials are juxtaposed. The ear-opening is large, with a very strong anterior denticulation. The dorsal scales are small and nearly uniform. Long series of femoral pores and a strong transverse gular fold are present. The lateral neck folds are spinose. The superciliaries are juxtaposed.

13.—**Sauromalus ater** Duméril. ALDERMAN LIZARD. CHUCK-WALLA.

Sauromalus ater, Duméril, Arch. Mus. d'Hist. Nat., VIII, 1856, p. 536, pl. XXIII, figs. 3, 3a (**no locality**).

Euphryne obesus, Baird, Proc. Acad. Nat. Sci. Phila., 1858, p. 253 (type locality **Fort Yuma, Cal.**); Baird, U. S. Mex. Bound. Surv., Rept. 1859, pl. XXVII.

Description.—Head and body very large, much depressed, the latter very broad. Head almost triangular, with narrow rounded snout, and covered with small plates largest on snout and temporal regions. Nostrils opening upward, outward, and slightly backward, in round plates a little nearer to end of snout than to orbits. Superciliaries, like supraoculars, small and juxtaposed. Suboculars all short, but strongly keeled. Rostral plate very small. Labial plates small and of about equal size. Symphyseal plate long but very narrow. Several series of slightly enlarged sublabials passing gradually into the finely granular gulars. Gular fold covered with very small scales. Ear-opening large, almost vertical, with strong anterior denticulation of spinose scales. A strong fold on each side of neck, bearing numerous spinose tubercles. Scales on back and sides small, largest medially and on strong lateral fold, smooth and juxtaposed except laterally, becoming there keeled and slightly imbricate. Ventral scales smooth, smaller than dorsals. Tail little longer than head and body, conical, very stout, and covered with whorls of small, weakly keeled, feebly spinose scales. Femoral pores very large, varying in number from fifteen to eighteen.

The head, neck, and limbs are dull brownish black with a few scattered scales of grayish yellow. The back is dark brown or dull straw-color speckled with red, straw-color, or dark brown, and sometimes crossed by several broad bands of dark brown or black. The tail is dull straw-color with or without wide rings of black or dark brown. The ventral surfaces are black or dark brown more or less relieved with dull yellow.

A living specimen was colored as follows: The head and neck are uniform black, as are also the upper surfaces of the arms and legs. The hands and feet are speckled with dull yellowish white. The central portion of the back is chiefly brick-red dotted with black and yellowish white. Its lateral portions are chiefly black, but are dotted with deep vermilion and yellowish white. The sides are similar to the central portion of the back, but with less white and with red of a darker shade. The chest is black with a continuation of the red of each side crossing it and meeting its fellow on the median line just behind the insertion of the fore limbs. The belly is black, dotted and spotted with red. The lower surfaces of the limbs are black spotted with yellowish white and sparsely speckled with red. The tail is either all white or white crossed by wide bands of black.*

Length to anus	180	210
Length of tail	198	215
Snout to orbit	14	19
Snout to ear	36	45
Width of head	35	44
Fore limb	76	87
Hind limb	102	121
Base of fifth to end of fourth toe	32	38

Distribution.—The Chuck-walla or Alderman Lizard inhabits suitable situations throughout the Colorado and Mojave Deserts. It has been taken at Fort Yuma and on the eastern slope of the Julian Mountains in San Diego County, and thence occurs north to the desert ranges in the vicinity of Panamint and Death Valleys, California. It ranges east across southern Nevada (Pahrump Valley) to southwestern Utah.

Habits.—This lizard, the largest native to California, shares with several others the curious habit of defending itself with its tail. As this organ is very large and muscular, the animal can strike very quick and well-aimed blows, and does so with great vigor when teased. "It was generally found on lava or other dark rocks with which its coloration harmonized. It is a vegetarian, feeding entirely, so far as our observations go, on the buds and flowers of plants, with the addition sometimes of a few leaves. It is much prized by the Panamint Indians as an article of food. A number were eaten by members of our expedition, and their flesh was reported to be tender and palatable."*

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*There is much variation in the coloration of this lizard, especially as regards the black bands of the tail. These may be present or absent in the same individual at different times, and the change seems to be, at least to some extent, directly under the control of the animal. When the specimen whose colors are described above was put in a jar with chloroform, the black bands of the tail disappeared and reappeared several times before the lizard's death. Dr. Stejneger has observed the same color changes and thought them dependent upon the intensity of the light to which the animal is exposed.

Genus II. UTA.

Uta, BAIRD & GIRARD, Proc. Ac. Nat. Sci., Phila., VI, 1852, p. 69 (type **stansburiana**). *Uro-saurus*, HALLOW., Proc. Ac. Nat. Sci. Phila., VII, 1854, p. 92 (type **graciosus**). *Phymatolepis*, DUMÉRIL, Arch. Mus. d'Hist. Nat., VIII, 1856, p. 548 (type **bicarinatus**).

The head and body are moderately depressed and much shorter than the tail. The head-plates are large, the largest (interparietal) being larger than the ear-opening. The dorsal scales are small and may be either uniform or heterogeneous. The labials are not imbricate. The ear-opening is large, with a strong anterior denticulation. One or more transverse gular folds and long series of femoral pores are present. The superciliaries are imbricate.

SYNOPSIS OF SPECIES.

a.—Dorsal scales or granules nearly equal, becoming gradually smaller laterally; an intense black band across shoulders or a blue patch behind axilla.
  b.—Dorsals juxtaposed, smooth; a narrow black band from shoulder to shoulder, above........................**U. mearnsi.**—p. 64.
  b^2.—Dorsals imbricate, keeled; no black band from shoulder to shoulder; a round blue patch behind axilla. .....**U. stansburiana.**—p. 66.
a^2.—Six or eight medial longitudinal series of dorsals largest, imbricate, keeled, becoming suddenly smaller laterally; no intense black band across shoulders or blue patch behind axilla.
  c.—Slender, tail more than twice head and body; enlarged dorsals subequal...................................**U. graciosa.**—p. 69.
  c^2.—Stouter, tail less than twice head and body; largest dorsals in four series, two on each side of the smaller median ones.
U. symmetrica.—p. 70.

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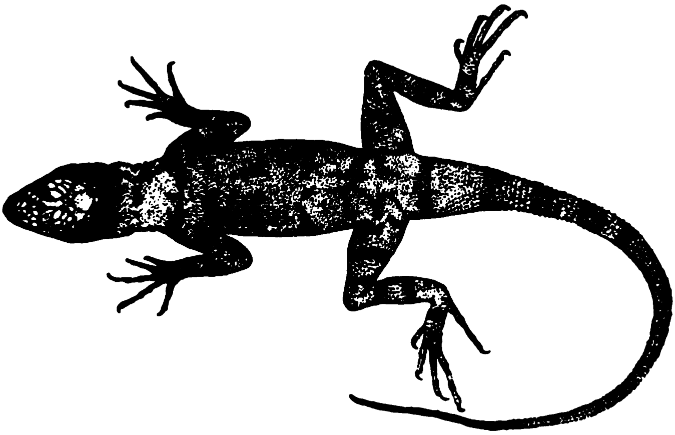
*Merriam, N. A. Fauna, No. 7, 1893, p. 174.

14.—**Uta mearnsi** Stejneger. MEARNS'S LIZARD.

Uta mearnsi, STEJN., Proc. U. S. Nat. Mus., XVII, 1894, p. 589 (type locality **Summit of Coast Range, United States and Mexican Boundary line, California**).

Description.—Head considerably depressed, snout very low. Canthus rostralis well marked, large nostrils opening almost upward in rounded plates much nearer to end of snout than to orbit. Plates on head large, smooth, and but slightly convex; interparietal largest. Frontal plate usually divided transversely. Two or three posterior series of supraoculars enlarged, separated from frontals by one or two series of granules. Superciliaries long and imbricate. A long, narrow, strongly keeled subocular, followed and preceded by similar but smaller plates. Rostral very wide and low, as also the five or six supralabials. Symphyseal plate large and followed by several large chin-shields. First infralabials much larger than others. Sublabials long and narrow. Skin on gular region covered with small, smooth, rounded granules, slightly largest centrally and near edge of strong gular fold. A dermal fold on each side between limbs. Back and sides covered with smooth, convex, rounded granules, largest medially, smallest laterally, and changing gradually to small, smooth, imbricate scales on belly. Tail and anterior and upper surfaces of limbs bearing larger imbricate scales, each provided with strong keel ending in projecting spine. Nineteen to twenty-five pores forming a series along each thigh. Males with enlarged postanal plates.

The color above is bluish gray or olive, strongly tinged with brown on the head and tail and crossed by irregularly undulate bands of dark gray or slate. A narrow straight band of intense black crosses from shoulder to shoulder over the back. The spaces between these bands are variously spotted, marbled, and reticulated with lighter. The limbs are irregularly cross-banded with dusky. The basal two-thirds of the tail is pale brownish olive with wide blackish cross-bars; its terminal third is uniform blackish. The lower surfaces are greenish white, suffused with bluish on the flanks, and reticulated with bluish gray or slate on the chin and throat.



Length to anus	75	79	82
Length of tail	140	150	
Snout to orbit			7
Snout to ear			20
Width of head			16
Fore limb		37	38
Hind limb		61	63
Base of fifth to end of fourth toe			22

Distribution.—This lizard has been found only on the eastern slope of the Coast Range of San Diego County California, near the Mexican boundary line. Here it is said to be "extremely plentiful" among rocks from the base to the summit of the range.

15.—**Uta stansburiana** Baird & Girard. Brown-shouldered Lizard.

Uta stansburiana, B. & G., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 69 (type locality **Valley of Great Salt Lake, Utah**), *and* Stansbury's Exped. Gt. Salt Lake, 1853, p. 345, pl. V, figs. 4–6.

Uta elegans, Yarrow, Proc. U. S. Nat. Mus., 1882, p. 442 (type locality **La Paz, L. C., Mex.**).

Description.—Body and head considerably depressed. Snout low, rounded and rather short, with well developed canthus. Nostrils large, opening upward and outward, nearer to end of snout than to orbit. Plates on head large, smooth, and usually more or less convex, interparietal largest. Frontal plate usually divided transversely. Three to five supraoculars enlarged and separated from frontals by one row of granules. Superciliaries long, somewhat projecting laterally, and strongly imbricate. Central subocular very long, narrow, and strongly keeled. Rostral and supralabials very long and low. Other plates of upper surface of head very irregular in size and position. Symphyseal plate rather small, followed by three or four pair of larger smooth plates separated from small infralabials by from one to three series of moderately enlarged sublabials. Gular region covered with small, smooth, hexagonal scales, which change gradually into granules on sides of neck, and into larger scales on strong transverse gular fold, where they are about the size of those on belly. Edge of gular fold with a series of larger projecting scales. Ear-opening with a strong denticulation of three or four pointed scales. Several longitudinal dermal folds usually present on sides of body and neck. Back covered with keeled scales of nearly uniform size, becoming gradually granular on neck and sides. Largest scales on tail,

strongly keeled, sharply pointed, and larger above than below. Posterior surfaces of thighs and arms covered with small granular scales similar to those of sides of body. Other surfaces of limbs provided with large scales, keeled except on ventral surfaces of thighs, legs, and arms. Femoral pores varying in number from twelve to seventeen. About twenty-three to twenty-eight dorsal scales equaling the shielded part of head.

This lizard displays a very great amount of variation in both the pattern and intensity of its coloring. The back and sides are variously striped, spotted, or marbled with dark brown, blue, green, gray, or yellow; the former often with a double series of large brown spots, light-edged behind, which usually are much more distinct in females and young than in adult males. The tail is similarly marked, but is often ringed with brown. Below, the general color is yellowish white, usually more or less tinged with greenish or bluish on the sides of the belly. The throat in adults is blue, dotted or narrowly banded on the chin and sides with white, yellow, or orange. There is a round indigo spot behind the axilla and usually a brown patch in front of the shoulder.

Length to anus	30	37	46	48	49	53
Length of tail	57	72		91	98	95
Snout to orbit	3	3	3	4	4	4
Snout to ear	8	10	11	11	12	13
Width of head	6	8	9	9	10	11
Fore limb	13	18	18	20	21	21
Hind limb	22	30	32	36	40	38
Base of fifth to end of fourth toe	9	13	13	15	16	15

Distribution.—The Brown-shouldered Uta is more generally distributed in southern California than any other lizard. It ranges over almost all of the desert and southern coast regions, besides the southern portion of the San Joaquin Valley and the lower levels of both slopes of the Sierra Nevada. It has been secured in San Diego (at Fort Yuma, Campo, San Diego, Witch Creek, Julian Mountains), Riverside (Indio, Cabazon, Banning, Riverside, San Jacinto, Hemet Valley), San Bernardino (Colton, Hesperia, Victor, Barstow, Needles, Leach Point Spring, Borax Flat), Los Angeles (San Pedro, Pasadena, Antelope Valley), Ventura (San Buenaventura), Santa Barbara (Santa Barbara), Kern (Mojave, Fort Tejon, Walker Pass, Kern River, Bakersfield, Caliente), Inyo (Lone Pine, Keeler, Coso, Panamint Mountains, Death Valley, Resting Spring, Round Valley), Fresno (Fresno, Pleasant Valley 10 miles west of Huron), Merced (five miles north of Los Banos), San Joaquin (five miles south of Lathrop), and San Benito (Bear Valley) Counties. It has also been found on Santa Cruz and San Clemente Islands.

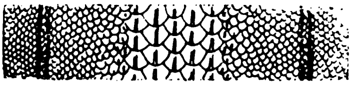
It crosses Nevada (Dome Cañon, Virginia City, Pahrump Valley, Vegas Valley, Pahranagat Valley, Ash Meadows, Charleston Mts., Virgin River) to Utah (St. George, Valley Great Salt Lake), Oregon (Warner's Valley, Summer Lake), and Idaho (Snake River).

Habits.—The Brown-shouldered Lizard is a ground-loving species usually found in open fields or deserts or among rocks. Upon the approach of an enemy it quickly retires to some hole or crevice and shyly peeps out from time to time to see if the intruder has departed. At the old mission of Santa Barbara these graceful little lizards are especially tame and abundant, and live among the stones of the walls and fountains, darting in and out of the crevices which once were filled with mortar, sunning themselves on the sheltered surfaces, or chasing one another with all the abandon and apparent delight of children playing tag.

16.—Uta graciosa (Hallowell). LONG-TAILED UTA.

Urosaurus graciosus HALLOW., Proc. Acad. Nat. Sci. Phila., 1854, p. 92 (type locality "Lower [=Southern] California);" *id.*, Rept. U. S. Pac. R. R. Surv., Vol. X, pt. IV, 1859, p. 4, pl. VII, figs. 1a-1e.

Description.—Body and tail very slender, former as well as head slightly depressed. Snout rounded but rather narrow, with nostrils opening in small round plates, much nearer to end of snout than to orbit. Plates on head moderately large, smooth and almost flat; interparietal largest. Frontal plate usually divided transversely. Inner series of enlarged supraoculars separated from frontal, frontoparietal, and parietal plates by one or two rows of granules. Superciliaries long, slightly projecting laterally, strongly imbricate. Central subocular very long, narrow and strongly keeled. Rostral and six or seven supralabials long and low. Symphyseal plate moderately large and followed by a series of plates separated from infralabials, except first pair, by one or two series of sublabial plates. Gular region covered with small, smooth, subhexagonal granules, which increase in size on, and are largest at edge of, strong, transverse gular fold. Ear-opening large, with denticulation of two or three scales, one being much larger than the others. Sides of neck and body more or less folded. About five to eight rows of imbricate, keeled, equal-sized scales forming a band down middle of back and changing very abruptly to granules on its sides. Some scales on upper lateral fold enlarged. Largest scales on the tail, larger above than below, and strongly keeled but not pointed. Posterior surfaces of thighs and arms covered with small granules similar to those on sides of body. Superior and anterior surfaces



of limbs provided with keeled scales. Femoral pores about ten to twelve in number on each thigh. Tail more than twice as long as head and body.

The general color above is grayish, becoming darker on the sides and slightly tinged with yellow on the snout. On the back are rather indistinct, wide, blackish cross-bars, which are often interrupted on the vertebral line and sometimes alternate. The tail is grayish with faint narrow rings of brown or slate. The limbs are cross-barred with dusky above. The lower surfaces are silvery white more or less flecked with black or slate. Males have a yellow patch on the throat and a long blue area on each side of the belly.

Length to anus	33
Length of tail	75
Snout to orbit	3
Snout to ear	8
Width of head	6
Fore limb	12
Hind limb	22
Base of fifth to end of fourth toe	9

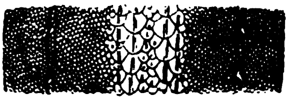
Distribution.—This lizard has been found only along the Colorado River. At Fort Yuma and The Needles, California, it is very rare and lives on or near the willows and mesquites, never on the open desert. In Nevada, it has been taken at Bunkerville, and at Callville, Lincoln County.

17.—**Uta symmetrica** Baird. TREE UTA.

Uta symmetrica, BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, p. 253 (type locality **Fort Yuma, Cal.**).

? *Uta schottii*, BAIRD, l. c., p. 253 (type locality **Sta. Madelina, Cal.**).

Description.—Head and body considerably depressed. Snout rounded but rather narrow, with well developed canthi above which the nostrils open much nearer to end of snout than to orbits. Plates on head moderately large, smooth, and almost flat; interparietal largest. Frontal plate usually divided transversely. Inner series of enlarged supraoculars separated from frontal, frontoparietal, and parietal plates by one or two rows of granules. Superciliaries long, very slightly projecting laterally, and strongly imbricate. Middle subocular very long, narrow, and strongly keeled. Rostral very wide and not very low. Four to seven long, low supralabials. Symphyseal plate moderately large and followed by series of large plates in contact with first pair of lower labials but separated from the others by one or two rows of sublabials. Chin and gular region covered with smooth subhexagonal granules, largest centrally and becoming imbricate on the strong transverse fold. Edge of fold with a series of projecting scales. Ear-opening large, with an anterior denticulation of from two to five pointed scales of much variation in size and shape. Two rows of medium-sized scales along middle of back, bordered on each side by two rows of much larger scales. Other dorsal scales very small, except a row of widely separated enlarged scales on upper of two lateral dermal folds. Tail bearing whorls of strongly keeled and sharply pointed scales much broader above than below. Posterior surface of thighs and arms covered with small granules similar to those on sides of body. Superior and anterior surfaces of limbs provided with large keeled scales. Ventral scales smooth and about size of those on edge of gular fold. Femoral pores varying from ten to fourteen in number on each thigh. Thirteen to seventeen of largest dorsal scales equaling length of shielded part of head. Tail



less than twice as long as head and body. Males with enlarged postanal plates.

The general color above is grayish or yellowish brown, paler and somewhat ochraceous on the head and the base of the tail, darkest along the upper lateral fold, and crossed by from six to eight light-edged bars of black or brown. These cross-bars are often very indistinct, usually interrupted on the middle of the back, and sometimes alternating with those on the opposite side. The light edgings of the dorsal bars may be either blue or yellow. The sides are often dotted with one or both of these colors. Narrow dark lines cross the top of the head, the most distinct being on the supraocular and frontal regions. In young specimens the dark coloring of the upper lateral fold is continued forward as a line, passing just above the ear-opening, crossing the orbit, and ending at the nostril. The tail is indistinctly ringed with dusky and often tinged with ochraceous. The lower surfaces are white, more or less dotted or suffused with dark brown or black. Males usually have a blue patch on each side of the belly and an area of lemon yellow, which sometimes acquires a tinge of blue, on the center of the throat.

Length to anus	30	36	49	54	55	59
Length of tail	49	58	85		95	102
Gular fold to anus	18	23	32	35	37	37
Snout to ear	8	9	11	12	12	13
Width of head	6	7	9	9	10	10
Fore limb	14	16	22	23	26	27
Hind limb	18	24	31	36	37	38
Base of fifth to end of fourth toe	7	10	14	14	14	16

Distribution.—The Tree Uta has been found in California only on the banks of the Colorado River near Fort Yuma, San Diego County. Its range seems not to extend much farther north, for a careful search failed to reveal its presence at The Needles in San Bernardino County.

Habits.—At Yuma this lizard is very abundant, but is rarely seen on the ground, preferring to climb over the rough bark of the willows or to hide between the planks of the railroad bridges. It feeds chiefly upon small insects.

Genus 12. SCELOPORUS.

Sceloporus, WIEGM., Isis, 1828, p. 369. "*Tropidolepis*, Cuv., R. A. (2), II, p. 38."

The head and body are slightly depressed and shorter than the tail. The head-plates are of moderate size, excepting the interparietal, which is very large. The dorsal scales are large, nearly equal sized, mucronate, and strongly imbricate. The ear-opening is large, with a well developed anterior denticulation. The labials are juxtaposed. There is no complete transverse gular fold, but a pouch is present on each side of the neck. Femoral pores are numerous. The superciliaries are imbricate.

SYNOPSIS OF SPECIES.

a.—Parietal and frontoparietal plates separated from enlarged supraoculars by a series of small scales or granules; scales on back of thigh smaller than those in front of anus.

b.—Dorsal scales very small, forty-five to sixty-six on the middle of the back between interparietal plate and base of tail; scales on back of thigh smooth........................S. graciosus.—p. 74.

b^2.—Dorsal scales larger, thirty-five to forty-six on a line between interparietal and base of tail; scales on back of thigh keeled.[*]

c.—Males with a blue patch on each side of the throat[†]; usually smaller.. ....S. occidentalis.—p. 77.

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[*] Sometimes smooth in young.

[†] I have examined many hundreds of specimens of *S. occidentalis* and *S. biseriatus* and have not found a male of the latter with two blue throat-patches. Highly colored males of *S. occidentalis* are sometimes found in which the two blue patches have extended to, and even merged on, the median line, but by securing very young, or less brilliantly colored, males there should be no difficulty in determining which species occurs in a given locality, for such males never have a single median blue patch if they belong with *S. occidentalis*, and never have two lateral patches if referable to *S. biseriatus*. Females of the latter species have either one or two blue patches, while those of the more northern form usually have two or none.

c^2.—Males with one blue patch on center of throat; usually larger.
S. biseriatus.—p. 80.

a^2.—Parietal and frontoparietal plates in contact with enlarged supraoculars; scales on back of thigh not smaller than those in front of anus.

d.—A strongly contrasted black blotch or collar in front of shoulder; dorsal scales distinctly keeled, with long points.
S. magister.—p. 84.

d^2.—No distinct black blotch or collar in front of shoulder; dorsal scales less distinctly keeled, or smooth, with short points.
S. orcutti.—p. 86.

18.—**Sceloporus graciosus** Baird & Girard. MOUNTAIN LIZARD.

Sceloporus graciosus, B. & G., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 69 (type locality **Valley of Great Salt Lake, Utah**); *and* Stansbury's Rept. Exped. Gt. Salt Lake, 1853, p. 346, pl. V, figs. 1-3.

Sceloporus gracilis, BAIRD & GIRARD, Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 175 (type locality **Oregon**); *and* GIRARD, U. S. Explor. Exped., Herp., p. 386, pl. 20, figs. 1-9.

Sceloporus vandenburgianus, COPE, Am. Nat., XXX, 358, Oct. 1896, p. 834 (type locality **Summit of Coast Range, San Diego Co., Cal.**).

Description.—Head and body somewhat flattened. Nostrils opening much nearer to end of snout than to orbits. Upper head-shields smooth, moderately large, and slightly convex; interparietal largest. Frontal usually divided transversely. Parietal, frontoparietal, and frontal plates separated from enlarged supraoculars by a series of small plates or granules. Superciliaries long, wide, and strongly imbricate. Middle subocular very long, narrow, and strongly keeled. Rostral plate very wide and rather high. Labials long, low, and almost rectangular. Below lower labials, some series of large sublabial plates. Symphyseal large and pentangular. Gulars small, smooth, imbricate, frequently emarginate posteriorly, about size of ventrals. Ear-opening large, slightly oblique, with an anterior denticulation of from four to seven accuminate scales. Dorsal scales equal-sized, keeled, pointed, larger than ventrals, and arranged in nearly parallel longitudinal rows. Scales on sides similar to those of back, but directed obliquely upward. No longitudinal dermal folds and no transverse fold on throat. Superior surfaces of limbs provided with keeled scales. Posterior surface of thigh covered with small, smooth scales. Ventrals smooth, but usually bicuspid. Caudal scales very much larger than dorsals, keeled and strongly pointed. Femoral pores varying in number from twelve to twenty on each thigh. Eleven to seventeen dorsal scales equaling length of shielded part of head. Number of scales in a row from interparietal plate to a line connecting posterior surfaces of thighs varying from forty-five to sixty-six; average in seventy-five specimens, fifty-five and one-half. Males with enlarged postanal plates.

The general color above is brown, olive, bluish or greenish gray, with one dorsal and two lateral series of closely set brown spots on each side. These spots have dark posterior and lateral edges, are usually larger and more distinct in females and young than in adult males, and are often more or less confluent, forming longitudinal bands separated by narrower bands of the lighter ground color. The head has no definite cross-lines, but the upper lateral band or series of spots is continued along the temple. The tail is very differently marked in different specimens, but usually shows traces of light and dark rings. Males have a large blue blotch, sometimes bordered internally with black, on each side of the belly, and the throat usually more or less washed with blue, which has a tendency to appear in narrow oblique lines. Females often lack the blue of the throat and sides of belly, but this color is sometimes present and is not infrequently bordered above by a band of bright reddish orange along each side of the body.

Length to anus	23	44	48	50	56	63
Length of tail	26	54	55	64	82	93
Snout to ear	6	10	11	11	12	12
Width of head	6	9	10	10	11	11
Shielded part of head	5	9	10	10	11	12
Fore limb	11	20	21	21	23	26
Hind limb	16	33	36	36	39	39
Base of fifth to end of fourth toe	7	14	14	15	15	16

Distribution.—This little lizard is a mountain-dwelling species throughout its range in California, which extends the whole length of the State. It is very abundant in Hemet and Strawberry Valleys, in the San Jacinto Mountains of Riverside County, but has not been reported from any of the more northern coast ranges.* On the western slope of the Sierra Nevada the Mountain Lizard has been found from Kern River north to Mount Shasta. It is common on the eastern slope of these mountains opposite Mono and Owen's Lakes and has been secured also in the Panamint Mountains. In the southern Sierra Nevada its vertical range extends from about 5,500 to nearly 9,000 feet above the level of the sea.

It has been taken in Nevada (Juniper Mts., Mt. Magruder), western Utah, southern Idaho (Blackfoot, Big Lost River, Lemhi Agency, and along Snake River from Pocatello to Weiser), Washington (Puget Sound, Cowlitz County), and Oregon (Dalles, Summer Lake, Grant's, Umatilla, etc.). In the north it is not restricted to the mountains.

Habits.—Nothing is known of the habits of this lizard except that it is a ground-loving species. The eggs, laid in June and July, are about 7x13 *mm.*, each inclosed in a tough, leathery, non-calcareous shell.

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*Since this was written I have seen a specimen shot in Berryessa Valley, Napa County.

19.—**Sceloporus occidentalis** Baird & Girard. BLUE-BELLIED LIZARD.

Sceloporus occidentalis, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 175 (type locality **California, probably Oregon**); GIRARD, U. S. Explor. Exped., Herp., p. 383, pl. 19, figs. 8–14.

Sceloporus frontalis, B. & G., Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 175 (type locality **Puget Sound**); GIR., U. S. Expl. Ex., Herp., p. 384, pl. 19, figs. 1–7.

Sceloporus bocourtii, BOULENGER, Cat. Liz. Brit. Mus., II, 1885, p. 229 [part] (**Monterey, Cal., Mt. Whitney, Cal., Santa Cruz**).

Description.—Head and body little depressed. Nostril opening much nearer to end of snout than to orbit. Upper head-shields smooth, moderately large, and slightly convex; interparietal much largest. Frontal usually divided transversely. Parietal, frontoparietal, and frontal plates separated from enlarged supraoculars by a series of small plates or granules. Superciliaries long and strongly imbricate. Middle subocular very long, narrow, and strongly keeled. Rostral plate of moderate height, but great width. Labials long, low, and nearly rectangular. Below lower labials and behind large pentangular symphyseal, some series of plates larger than gulars. Latter smooth, imbricate, and usually emarginate posteriorly. Ear-opening large, slightly oblique, with an anterior denticulation of smooth, accuminate scales. Scales on back equal-sized, keeled, pointed, and arranged in nearly parallel longitudinal rows. Scales on sides similar to those on back, but much smaller and directed obliquely upward. No longitudinal dermal folds and no transverse fold on throat. Upper surfaces of limbs provided with large, keeled scales. Posterior surface of thigh covered with small, accuminate, keeled scales. Ventral scales much smaller than dorsals, smooth, imbricate, and usually bicuspid. Tail furnished with irregular whorls of strongly keeled and pointed scales, much larger and rougher above than below. Femoral pores varying in number from thirteen to twenty on each thigh. Seven to twelve dorsal scales equaling length of shielded part of head. Number of scales in a row from the interparietal plate to a line connecting posterior surfaces of thighs varying from thirty-five to forty-six; average in thirty specimens, forty-one and eight-tenths. Males with enlarged postanal plates.

The color above is grayish, brownish, or olive, usually with one series of crescent-shaped or triangular brown spots, edged posteriorly with pale blue or green, on each side. A paler longitudinal band usually separates the dorsal and lateral regions. The sides are brownish or buffy, mottled with darker brown and dotted with green or pale blue. Narrow brown lines cross the head, but are more or less interrupted. A brown line connects the orbit and upper corner of the ear and is continued backward on the neck. A large blue patch on each side of the belly is usually bordered internally by a black band of varying width. The throat is white, more or less dotted or suffused with slate or black, and with or without a blue patch on each side. In highly colored males the black bands of the belly meet medially and the throat is intensely black with large round blue patches, which sometimes merge on the median line. The chest is white or yellowish, often dotted or suffused with black. The preanal region and the lower surfaces of the limbs are white, sometimes dotted or tinged with slaty-black. The posterior surfaces of the limbs are yellowish, deepest on the thighs, along the back of which runs a dark line. In young, and some females, the green edging of the dorsal spots is replaced by gray or buff.

Length to anus	27	44	67	68	68	70
Length of tail	31	64	94	88	104	93
Snout to ear	7	11	15	14	15	14
Width of head	6	9	13	13	13	13
Shielded part of head	7	10	14	14	14	14
Fore limb	12	20	30	28	30	30
Hind limb	17	33	47	44	48	48
Base of fifth to end of fourth toe	7	14	20	16	20	20

Distribution.—The Blue-bellied Lizard is a northern species, which, coming to us from Oregon, occupies the long coastwise strip of California lying to the west of the Sacramento and San Joaquin Valleys. Close to the coast, its range extends as far south as Ventura County. In the north, its territory stretches eastward at least as far as Mount Shasta and probably extends some distance south in the Sacramento Valley and on the western slope of the Sierra Nevada. Farther south, it crosses the San Joaquin Valley to the western slope of the Sierra Nevada. I have examined specimens from Siskiyou (Sissons, Fort Jones), Mendocino (Fairbanks), Lake (Kelseyville), Sonoma (Healdsburg, Santa Rosa), Napa (Calistoga, Napa, Ætna Springs), Marin (San Anselmo, Mill Valley), Contra Costa (Mount Diablo, Crockett), Alameda (Oakland, Calaveras Valley, Livermore, Altemonte), San Francisco, San Mateo (Pescadero, La Honda), Santa Clara (Palo Alto, Black Mountain, Santa Clara, Los Gatos, Alum Rock Cañon, Smith Creek, Canada Valley), Santa Cruz (Soquel), Monterey (Monterey, Pacific Grove, Pleyto), San Benito (Bear Valley, San Benito Valley), San Luis Obispo (San Miguel, San Luis Obispo), San Joaquin (Tracy, San Joaquin Bridge), Merced (near Merced), Tuolumne (Big Oak Flat, Groveland to Crocker's, Hodgdon's), Fresno (Los Gatos Cañon), Santa Barbara (Santa Barbara), and Ventura (San Buenaventura) Counties, California.

It ranges north across western Oregon and Washington to the Straits of Juan de Fuca.

Habits.—The Blue-bellied or Western Fence Lizard is by far the most numerous of its tribe in western central California. It is usually to be found about fences, piles of wood or stone, the great brush-heap homes of the wood-rat *(Neotoma)*, or roadside banks honeycombed with abandoned gopher *(Thomomys)* holes, which afford it ample opportunity to hide upon the approach of danger. Its coloration, especially the intensity of the black of the lower surfaces and the blue of the throat, is subject to much variation in the same individual, and is more or less dependent upon the coloring of surrounding objects.

In winter it is sometimes found in the interior of decaying logs, but I believe that it more frequently hibernates under ground.

20.—**Sceloporus biseriatus** Hallowell. FENCE LIZARD.

Sceloporus bi-seriatus, HALLOW., Proc. Acad. Nat. Sci. Phila , 1854, p. 93 (type locality **border of El Paso Creek and in Tejon Valley [California]**); *and* U. S. Pac. R. R. Surv., Rept., X, pt. IV, 1859, p. 6, pls. VI, figs. 2a–2f, & VIII.

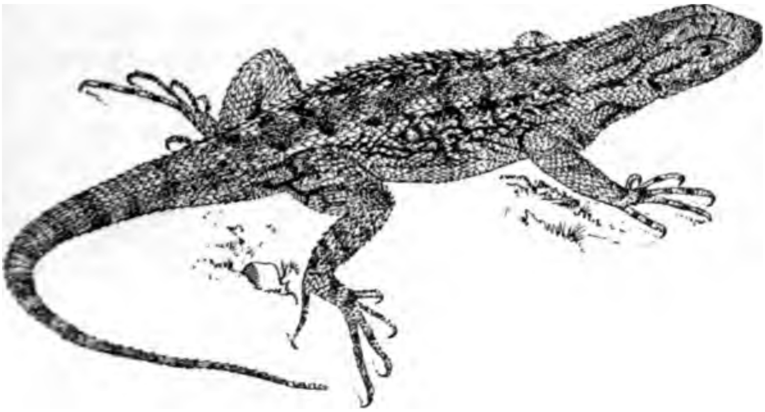
Sceloporus longipes, BAIRD, Proc. Acad. Nat. Sci. Phila., 1858, p. 254 (type locality **Fort Tejon, Cal.**).

Sceloporus smaragdinus, COPE, Wheeler's Surv. W. 100th Meridian, V, p. 572, pl. XXIV, figs. 2, 2a (type localities **Beaver, Utah; Nevada; Dome Canon, Utah**).

Sceloporus bocourtii, BOULENGER, Cat. Lizards Brit. Mus., II, 1885, p. 229 [part], type localities **Monterey, Cal., Mt. Whitney, Cal., Santa Cruz**).

Description.—Head and body little depressed. Nostril opening much nearer to end of snout than to orbit.

Upper head-shields smooth, moderately large, and very slightly convex; interparietal much largest. Frontal usually divided transversely. Parietal, frontoparietal, and frontal plates separated from enlarged supraoculars by a series of smooth plates or granules. Superciliaries long, wide, and strongly imbricate. Middle subocular very long, narrow, and strongly keeled. Rostral plate of moderate height, but great width. Labials long and low. Below lower labials and behind large pentangular symphyseal some series of plates larger than gulars. Latter of moderate size, smooth, imbricate, and usually emarginate posteriorly. Ear-opening large, slightly oblique, with an anterior denticulation of smooth accuminate scales. Back with equal-sized, keeled, pointed scales arranged in nearly parallel longitudinal rows. Scales on sides similar to those on back but much smaller and directed obliquely upward. No longitudinal folds and no transverse fold on throat. Superior surfaces of limbs provided with large, keeled scales. Posterior surface of thigh covered with small, accuminate, keeled scales. Ventral scales much smaller than dorsals,



smooth, imbricate, and usually bicuspid. Tail with irregular whorls of strongly keeled and pointed scales much larger and rougher above than below. Femoral pores varying in number from thirteen to eighteen on each thigh. Seven to eleven dorsal scales equaling length of shielded part of head. Number of scales in a row from interparietal plate to a line connecting posterior surfaces of thighs varying from thirty-five to forty-four; average in thirty specimens, forty and two-tenths. Males with enlarged postanal plates.

The back is brown, olive, or grayish buff, marked with large blotches or undulate cross-bands of dark brown and more or less dotted, spotted, or blotched with green or pale blue. The sides are similarly colored. Above, the head is brown or olive with narrow lines of dark brown, which are most distinct between the eyes and on the temples. The tail is olive or brown with irregular dark brown rings. All the lower surfaces are grayish or yellowish white, often suffused with slate or dull black. Along each side of the belly is a large patch of deep blue, usually bordered internally by a black band of varying width. Males have one large central throat-patch of deep blue, but females may have two lateral patches. The posterior surfaces of the limbs are yellow.

Length to anus	41	45	68	72	77	78
Length of tail	64	69	108	103		
Snout to ear	10	11	15	15	17	17
Width of head	8	9	13	13	14	14
Shielded part of head	9	11	14	14	15	15
Fore limb	19	23	32	31	35	35
Hind limb	31	35	51	51	56	55
Base of fifth to end of fourth toe	13	15	22	20	21	22

Distribution.—The Fence Lizard, or Tree Swift as it is sometimes called, occupies the coast region south of the range of *Sceloporus occidentalis* and both slopes of the Sierra Nevada, together with portions of the San Joaquin Valley and the desert ranges farther east. How far north it lives on the western slope of the Sierra Nevada and where it meets *Sceloporus occidentalis*, we do not know. It doubtless occurs throughout the whole length of the Great Basin, for it is common in Idaho. Its vertical range in central California extends up to about 8,000 feet.

I have examined specimens from San Diego (San Diego, Mexican border between Campo and the coast, Cuyamaca Mts., Witch Creek, Santa Ysabel Valley 3,000–4,000 feet, Julian Mts.), Riverside (Cahuilla Valley, Strawberry Valley, Hemet Valley 5,000 feet, San Jacinto, Temescal, Riverside), Los Angeles (Alhambra, Pasadena), San Bernardino (Mojave River near Victor, Warren's Wells, Lytle Creek), Kern (Fort Tejon, Tejon Pass, Walker Basin, Havilah, Kernville, Walker Pass), Tulare (South Fork Kern River, Tulare, Visalia, Three Rivers, East Fork Kaweah River 1,650–5,200 feet, Shotgun Cañon, Kern River Lakes 7,000 feet), Fresno (Fresno, Horse Corral Meadows, San Joaquin River 7,500), Mariposa (Nevada Falls Yosemite Valley, Mariposa), and Inyo (Coso Mts., Argus Mts., near Owen's Lake, Mt. Whitney, Independence Creek, White Mts., Round Valley) Counties, California.

It crosses Nevada (Charleston Mts., Mt. Magruder, Juniper Mts., Grapevine Mts., Pyramid Lake) to Utah and Idaho (along Snake River), and probably occurs in eastern Oregon.

Habits.—Like its northern congener—*S. occidentalis*—and its larger relative of the desert—*S. magister*—the Fence Lizard frequently performs a curious exercise while watching an intruder and determining whether he be friend or foe. Clinging to the rough bark of a tree or the lichen-painted surface of some old fence, it rapidly raises and lowers its head and body, often attracting attention to itself where the harmony of coloring would prevent its being noticed if motionless. It is rarely seen in open fields, preferring wooded districts or areas where rocks abound.

21.—**Sceloporus magister** Hallowell. SCALY LIZARD.

Sceloporus magister,* HALLOW., Proc. Acad. Nat. Sci. Phila., 1854, p. 93 (type locality near **Fort Yuma, California**); *and* U. S. Pac. R. R. Surv. Rept., X, pt. IV, 1859, p. 5; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 178, pl. I, figs. 2a–2c.

Description.—Head and body little depressed. Nasal opening slightly nearer to end of snout than to orbit. Upper head-plates smooth, often a little convex, and usually slightly imbricate; interparietal largest. Frontal divided transversely. Parietal and (usually) frontoparietal plates not separated from large supraoculars. Latter very broad, as also the strongly imbricate superciliaries. Middle subocular very long, narrow, and strongly keeled. Rostral plate wider than high. Labials long but very low, inferior larger than superior. Symphyseal large, followed by several plates larger than gulars and separated from lower labials by from one to three rows of narrow sublabials. Gular region with scales smooth, flat, bicuspid, and strongly imbricate, as also belly. Ear-opening large, nearly vertical, and protected by a series of very long accuminate scales. Back with equal-sized, rather weakly keeled, but strongly pointed, scales arranged in nearly parallel longitudinal rows. Scales of sides pointed obliquely upward and changing gradually from carinate dorsals to smaller smooth ventrals. No longitudinal dermal folds. Upper

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*This species was long confused with *S. clarkii*, which is not Californian.

surfaces of limbs provided with strongly keeled and pointed scales. Scales on posterior surface of thigh large, accuminate, strongly keeled and pointed. Upper caudal scales similar to dorsals, but having longer points. Femoral pores varying in number from eleven to fifteen on each thigh. Five to ten dorsal scales equaling length of shielded part of head. Number of scales in a row from interparietal plate to a line connecting posterior surfaces of thighs varying from twenty-nine to thirty-five; average in thirty specimens, thirty-one and two tenths. Males with enlarged postanal plates.

The back is gray, yellow, brown, or copper-color, without distinct markings or with a very broad (4–5 scales) band of dark brown along its anterior half in adult males, irregularly spotted or blotched with dark brown in females and young. There is a strongly contrasted black bar or collar in front of each shoulder. Faint indications of dark lines may sometimes be seen on the head. The tail is brown or olive with indistinct brown rings or cross-bars. In highly colored males, the throat has a central patch of blue, which gradually fades anteriorly and changes to black posteriorly. The belly has lateral bands of deep blue, more or less bordered or replaced with black. The scales of the sides are variously tinted with black, blue, green, yellow, orange, red, and brown. There usually is a black area in front of the thigh. In females and young, the throat and belly are usually white or grayish yellow.

Length to anus	35	50	68	88	106	109
Length of tail	51	67	99	112	149	158
Snout to ear	10	12	16	20	24	25
Width of head	9	10	14	16	24	25
Shielded part of head	10	11	15	17	20	20
Fore limb	17	24	31	42	45	53
Hind limb	27	35	49	58	68	72
Base of fifth to end of fourth toe	11	14	19	23	25	28

Distribution.—The Scaly Lizard may be considered a member of the desert fauna, although I secured a specimen near the mouth of the Los Gatos Cañon, about six miles above Coalinga, in the southwestern part of Fresno County. It is not rare along the Colorado River, both at Fort Yuma in San Diego County and at The Needles in San Bernardino County. In the latter county, it has been taken also near the Mojave River at Barstow, at Victor, at Warren's Wells, among the tree-yuccas at Hesperia, and on the desert near the base of Granite Mountains. Specimens have been taken at Mojave Station and Walker Pass, in Kern County, and near Lone Pine and in the Panamint and Argus Mountains in Inyo County, California.

It crosses southern Nevada to southwestern Utah, the most northern locality at which it has been taken being the Big Bend of the Truckee River, Nevada.

Habits.—This large lizard is rarely seen on the open desert, preferring the shelter of yuccas, mesquites, cottonwoods, and willows, about which it climbs with great agility. Dr. Merriam says it "is a mixed feeder, both insects and flowers being found in the stomachs examined."

22.—**Sceloporus orcutti** Stejneger. DUSKY SCALY LIZARD.

Sceloporus orcutti, STEJN., N. A. Fauna, No. 7, 1893, p. 181 (footnote) pl. 1, figs. 4a–4c (type locality **Milquatay Valley, San Diego County, California**).

Description.—Head and body much depressed. Nasal opening a little nearer to end of snout than to orbit. Upper head-plates smooth and usually somewhat convex, supraoculars often slightly imbricate. Frontal divided transversely. Parietal and frontoparietal plates not separated from large supraoculars. Latter very broad, as also the strongly imbricate superciliaries. Middle subocular very long, narrow, and strongly keeled. Rostral plate much broader than high. Labials long but very low, inferior slightly larger than superior. Symphyseal large and followed by several plates larger than gulars and separated from lower labials by from one to three rows of narrow sublabials. Gular region with scales smooth, flat, bi- or tricuspid, and strongly imbricate, as also belly. Ear-opening large, nearly vertical, and protected by a series of long, accuminate scales. Scales of back in nearly parallel longitudinal rows, equal-sized, with no keels or very obtuse ones, and points which scarcely protrude beyond the serrate posterior outline. Scales of sides pointed obliquely upward and changing gradually from smoother dorsals and smaller smooth ventrals, becoming keeled and strongly pointed. No longitudinal dermal folds. Upper surfaces of limbs provided with strongly keeled and pointed scales. Scales on posterior surface of thigh large, accuminate, strongly keeled and pointed. Upper and lateral caudal scales nearly smooth, but with very long points. Femoral pores varying in number from twelve to sixteen on each thigh. Six to twelve dorsal scales equaling length of shielded part of head. Number of scales in a row from the interparietal plate to a line connecting posterior surfaces of thighs, thirty-one to thirty-seven; average in fifteen specimens, thirty-three and six-tenths. Males with enlarged postanal plates.

In very young specimens the back is crossed by numerous dark brown bands separated by narrower ones of paler brown. The narrow bands gradually become more or less greenish or bluish and some of the dorsal scales become copper-color with blue centers. In adult males the cross-bands have almost or entirely disappeared and the back and sides are finely mottled with brown, gray, green, blue, and copper-color. The upper head-plates are brown with pale centers. The tail is cross-barred with dark and light brown or green. The throat and belly of young specimens are bluish or yellowish white with oblique dusky bands corresponding to those on the sides of the head and body. In adult males the throat and belly are nearly uniform dull purplish cyanine blue, the edges of the scales often being black or reddish brown. There is a slightly darker area in front of the shoulder, but no distinct blotch or collar is present.

Length to anus	39	72	86	100	106	109
Length of tail	52	102	118	115	119+	122+
Snout to ear	10	17	17	20	20	21
Width of head	9	15	17	20	21	21
Shielded part of head	10	15	16	18	19	19
Fore limb	19	34	39	45	44	48
Hind limb	28	52	56	66	64	67
Base of fifth to end of fourth toe	11	20	22	24	23	25

Distribution.—The Dusky Scaly Lizard has been found only in the coast ranges of Riverside and San Diego Counties, California, and in the northern part of Lower California. Originally described from Milquatay Valley, it has since been secured between Campo and the coast, at Witch Creek, in Clogston's Valley, Cahuilla Valley, Strawberry Valley, Hemet Valley, and at San Jacinto, Riverside, and Temescal.

Habits.—This lizard of the rocks is common near San Jacinto, but is very timid, rarely permitting the collector to approach near enough to use fine shot with deadly effect. In the cool of the morning and late in the afternoon it may be seen upon the highest point of some rounded boulder, but during the warmer hours it avoids the direct rays of the sun and must be sought on the shady sides of the granite, into whose crevices it quickly disappears when approached too closely.

Genus 13. PHRYNOSOMA.

Phrynosoma, WIEGM., Isis, 1828, p. 367; *Batrachosoma*, FITZINGER, Syst. Rept., 1843, p. 79 (type coronatum); *Anota*, HALLOW., Proc. Ac. Nat. Sci. Phila., 1852, p. 182 (type m'callii); *Doliosaurus*, GIRARD, U. S. Explor. Exped., Herp., 1858, p. 407.

The body is very broad, greatly depressed, without dorsal crest, but usually with a lateral fringe. The head is covered with small subequal scales and bears bony spines on the occipital and temporal regions. The tympanum is either distinct or partially or entirely scaled. The dorsal scales are very irregular in size and shape. Series of femoral pores and one or more transverse gular folds are present. The tail is short. Males have enlarged postanal plates.

SYNOPSIS OF SPECIES.

a.—Nostrils opening on or almost on the lines joining the supraorbital ridges with the end of the snout.

b.—Gular scales small, nearly equal-sized; a series of enlarged scales below, but not much larger than, the lower labials; occipital spines very short.........................P. douglassii.—p. 90.

b².—Several longitudinal series of enlarged pointed gular scales; a series of very large spinose plates below the lower labials; head-spines large.

c.—Head-shields convex and almost smooth.

P. blainvillii.—p. 91.

c².—Head-shields flat, with numerous ridges and granulations.

P. frontale.—p. 93.

a².—Nostrils opening well above the lines joining the supraorbital ridges with the end of the snout; a series of very large shields below the lower labials; gular scales small, equal or with one row of enlarged scales on each side.

d.—One series of small peripheral spines; six to twelve femoral pores; no narrow dark median dorsal line....P. platyrhinos.—p. 98.

d².—Two or three series of peripheral spines; eighteen to twenty femoral pores; a narrow dark median dorsal line.

P. m'callii.—p. 100.

23.—**Phrynosoma douglassii** (Bell). PIGMY HORNED TOAD.

Agama Douglassii, BELL, Trans. Linn. Soc., XVI, p. 105, pl. X (type locality **Columbia River**).

Phrynosoma douglassii, GIRARD, Stansbury's Exped. Gt. Salt Lake, 1853, p. 362, pl. VII, figs. 6–10.

Phrynosoma douglassi pygmæa, YARROW, Proc. U. S. Nat. Mus., V. 1882, p. 443 (localities **Ft. Walla Walla, Wash.**; **Des Chutes River, Oreg.**; **Ft. Steilacoom**): YARROW, Bull. U. S. Nat. Mus., No. 24, 1882, p. 70 (type locality stated as Des Chutes R., Oreg.); TOWNSEND, Proc. U. S. Nat. Mus., X, 1887, p. 238.

Description.—Nostrils opening on lines joining superciliary ridges with end of snout. Gular scales small and nearly equal-sized. A series of enlarged sublabial scales not much larger than infralabials, separated from latter by several rows of granules. Head-spines very short; four or five temporals, one occipital, and one postorbital on each side. Occipital spines nearly erect. Supralabials small but prominent. Infralabials slightly larger than supralabials and continued farther back, becoming gradually spinose. Other head-scales small, irregular in size and arrangement, more or less convex, and roughened with ridges and granulations. Two groups of spines on neck, upper being larger. Back, tail, and upper surfaces of limbs with scattered, large, more or less erect, keeled, tubercular scales; between these, skin covered with smaller scales and granules. Body with fringe of one series of peripheral spines. Chest and belly and lower surfaces of hind limbs and tail covered with small smooth scales. Tympanum either naked or scaled. Long series of femoral pores almost meet medially. Males sometimes with enlarged postanal plates.

The back is olivaceous, yellow, brown, gray, or slate, with two or four rows of dark blotches. These blotches vary greatly in intensity but are almost always edged posteriorly with white, gray, or yellow. There is an indistinct large dark blotch on each side of the neck. The coloring of the tail is similar to that of the back. The ground color of the head is very variable, as are also its darker markings. The entire lower surface is white or pale yellow, sometimes faintly marked with gray or slate.

Length to anus	24	46	58	60	60	61
Length of tail	9	25	29	30	25	28
Snout to ear	6	12	15	15	14	15
Width of head	8	14	16	17	17	18
Length of occipital spine		1	1¼	1⅓	1¼	1⅛
Fore limb	12	20	25	24	24	24
Hind limb	16	26	34	33	33	33
Base of fifth to end of fourth toe	5	8	10	10	10	10

Distribution.—Washington, Oregon, and Idaho contain the greater part of the range of this lizard. Mr. Chas. H. Townsend has recorded it from the northern base of Mount Shasta, California, which is, I believe, the only definite locality at which the Pigmy Horned Toad has been found in this State, although it probably occurs in many parts of Siskiyou and Modoc Counties.

It has been recorded from Fort Steilacoom, Fort Walla Walla, and North Yakima, Washington; from Grant's, Des Chutes River, Willamette Valley, and between Warner's and Goose Lakes, Oregon; and from Blackfoot, Big Butte, Big Lost River, Pocatello, vic. Lewiston, Conant, Arco, and American Falls, Idaho.

24.—**Phrynosoma blainvillii** Gray. BLAINVILLE'S HORNED TOAD.

Phrynosoma Blainvillii, GRAY, Zool. Beechey's Voy., 1839, p. 96, pl. XXIX, figs. 1 (type locality **California**).*

Description.—Nostrils opening on lines joining superciliary ridges with end of snout. Head-spines large;

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* Many authors have confused this species and *P. frontale* with *P. coronatum* Blain., of Lower California, which does not live in California.

three to six temporals, one occipital, and one postorbital on each side, and one small interoccipital. Sometimes with small spines above and between temporals and often in front of occipital spines. Temporal scales with ridges running in the general direction of temporal spines. Other upper head-scales convex and almost or quite smooth. Several longitudinal series of gular scales enlarged and spinose, but becoming smaller toward median line, and continued on gular fold or folds. A series of five or six spinose sublabials, often continued posteriorly by smaller plates. Below corner of mouth, a very broad spine followed by a long slender one. Two groups of spines on each side of neck, lower usually larger. Back and tail with large, scattered, somewhat elevated, keeled, tubercular scales, between which smaller scales and granules. Two rows of peripheral spines; lower series shorter than upper and composed of smaller spines. Tail edged with a single row of lateral spines and bearing a small group of slender spines just behind thigh. Scales on anterior surfaces of limbs large, pointed, and strongly keeled. Those on chest, abdomen, and proximal part of ventral surface of tail smooth, but those on terminal portion of tail keeled. Tympanum not covered with scales. Long series of (12 to 18) femoral pores present. Males usually with enlarged postanal plates.

The ground color above is brownish, yellowish, reddish, or grayish, usually darker laterally. A large brown patch occupies each side of the neck. On the back are undulate cross-bands or large irregular spots of dark brown, usually edged posteriorly with yellow or white. Similar markings are seen on the tail. The head is usually yellow, but may be clouded with slate. Its larger spines are often reddish. The lower surfaces are yellow or yellowish white, uniform or mottled with slate or gray. All markings are usually more distinct in young than in old specimens, but are very variable in both.

Length to anus	29	74	88	88	92	98
Length of tail	13	40	40	43	38	47
Snout to ear	8	15	17	18	18	18
Width of head[*]	11	26	30	30	30	32
Length of occipital spine	2	6	10	11	9	9
Fore limb	14	34	38	39	38	40
Hind limb	19	44	52	54	52	53
Base of fifth to end of fourth toe	6	14	15	17	15	15

Distribution.—Blainville's Horned Toad is an inhabitant of the coastal slopes of San Diego, Riverside, San Bernardino, and Los Angeles Counties, California, where it has been taken at San Diego, Twin Oaks, Oak Grove, Clogston's Valley, San Jacinto, Hemet Valley, Banning, Riverside, Lytle Creek, Warren's Wells, Ontario, Pasadena, and Alhambra. It has not been collected on the desert proper and doubtless does not live there, although it is not rare in San Gorgonio Pass. Where it meets *P. frontale* is not known.

25.—**Phrynosoma frontale** Van Denburgh. CALIFORNIA HORNED TOAD.

Phrynosoma frontalis, VAN D., Proc. Calif. Acad. Sci., Ser. 2, IV, p. 296 (type locality **Bear Valley, San Benito County, California**).

Description.—Nostrils open on lines joining superciliary ridges with end of snout. Head-spines usually a little smaller than those of *P. blainvillii;* three to six temporals, one occipital, and one postorbital on each side, and one small interoccipital. Sometimes with small spines above and between temporals and usually in front of occipitals. Temporal scales with ridges running in the general direction of temporal spines. Other upper head-scales flat, each with numerous ridges and granulations usually darker than ground color of head. Several longitudinal series of gular scales enlarged and spinose, but becoming smaller toward median line, and continued back onto gular fold or folds. A series of five or six large spinose sublabials, often continued posteriorly by smaller plates. Below corner of mouth, a very broad spine followed by a long slender one. Two groups of spines on each side of neck, lower usually larger. Back and tail bearing large, scattered, elevated, keeled, tubercular scales, between which smaller scales and granules. Two rows of peripheral spines; lower series shorter than upper and composed of much smaller spines. Tail bordered with a single row of lateral spines and having a small group of slender ones just behind thigh. Scales on anterior surfaces of limbs large, pointed, and strongly keeled. Those on chest, belly, and proximal part of the tail smooth, but those on terminal part of tail keeled. Tympanum not covered with scales. Long series of femoral pores present. Males usually with enlarged postanal plates.

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[*] To tips of temporal spines.

The upper surfaces are variously tinted with yellow, brown, red, gray, or slate. A large brown patch occupies each side of the neck. On the back are undulate cross-bands or large blotches of dark brown, usually edged posteriorly with white or yellow. Similar markings may be seen on the tail. The keels of many of the large dorsal tubercles are dark brown. The head is yellowish, usually dotted with brown. Its larger spines are sometimes reddish. The lower surfaces are yellow or yellowish white, uniform or mottled with slate or gray. All markings are usually more distinct in young than in old specimens, but are very variable in both, the intensity of coloring depending very greatly upon the color of surrounding objects and changing in the same individual in the course of a very few minutes.

Length to anus	31	38	55	74	87	89
Length of tail	10	15	22	34	40	36
Snout to ear	6	8	11	15	16	17
Width of head*	9	13	17	23	26	26
Length of occipital spines	2	3	5	7	6	6
Fore limb	13	17	24	34	33	36
Hind limb	17	22	32	47	46	51
Base of fifth to end of fourth toe	5	7	10	14	13	16

Distribution.—This lizard occupies a much larger area in California than does *Phrynosoma blainvillii.* The most southern localities from which I have seen specimens are in Kern County (Fort Tejon, Kernville, Bakersfield). Thence it ranges north across Tulare, Kings, Fresno, Merced, and San Joaquin Counties. Farther west, it has been taken in San Benito (Bear Valley), Monterey (Monterey, Pacific Grove), Santa Clara (Cañada Valley, Coyote Creek, Santa Clara, Mayfield, Los Gatos, Wright's, Morgan Hill), and San Mateo (Searsville) Counties. We do not know how much farther north this horned toad lives, but Dr. Boyle collected one in El Dorado County. It does not occur east of the Sierra Nevada.

Horned toads from Santa Barbara and Ventura Counties will probably be found to be intermediate between this and the preceding species, in which case this form must be known as *Phrynosoma blainvillii frontale.*

Habits.—Their grotesqueness of form, slowness of movement, and the ease with which they may be fed, cause these lizards to be much sought as pets. In confinement they are usually very docile and become so tame that they will readily take flies or other small insects from the fingers of their keeper. Individuals which have been recently caught, however, often show considerable anger when handled, puffing themselves up and hissing fiercely, seizing their tormentor's fingers with their impotent jaws, or throwing at him a stream of blood from the corner of the eye. It is said that the Mexicans call them sacred toads because they weep tears of blood. The best account of this most curious habit has been given us by Dr. O. P. Hay,* who, writing of a specimen of *Phrynosoma frontale*, says, in part:

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*To tips of temporal spines.

"About the first of August it was shedding its outer skin and the process appeared to be a difficult one, since the skin was dried and adhered closely. One day it occurred to me that it might facilitate matters if I should give the animal a wetting; so, taking it up, I carried it to a wash-basin of water near by and suddenly tossed the lizard into the water. The first surprise was probably experienced by the *Phrynosoma*, but the next surprise was my own, for on one side of the basin there suddenly appeared a number of spots of red fluid, which resembled blood. * * * A microscope was soon procured and an examination was made, which immediately showed that the matter ejected was really blood. * * * There appeared to be a considerable quantity of the blood, since on the sides of the vessel and on the wall near it I counted ninety of the little splotches. * * * The next day * * * I picked up the lizard and was holding it between my thumb and middle finger, and stroking its horns with my fore finger. All at once a quantity of blood was thrown out against my fingers, and a portion of it ran down the animal's neck; and this blood came directly out of the right eye. It was shot backward and appeared to issue from the outer canthus. It was impossible to determine just how much there was of the blood, but it seemed that there must have been a quarter of a teaspoonful. I went so far as to taste a small quantity of it, but all I could detect was a slight musky flavor.

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*Proc. U. S. Nat Mus., XV, 1892, p. 375.

"Mr. Denton * * * has communicated to me his experience with the Horned Toad * * * at Sonora, Cal. * * * He was gently stroking the animal on the back, when it appeared to look at him as if taking aim, and then, all at once, a stream of blood was shot into his eye. There was so much of it that it ran down on his shirt bosom. He thought there was between a tablespoonful and a teaspoonful. The blood was shot out with so much force that some pain was produced, and there was pain felt for some little time, though this ceased as soon as the blood was wiped out. The next morning the eye was somewhat inflamed, but this condition soon passed away. Not long afterwards, perhaps the next morning, the animal squirted blood out of the other eye."

Mr. Vernon Bailey, who caught the horned toad which afterwards became the subject of Dr. Hay's article, writes:*

"On taking it in my hand a little jet of blood spurted from one eye a distance of 15 inches and spattered on my shoulder. Turning it over to examine the eye another stream spurted from the other eye. This he did four or five times from both eyes until my hands, clothes, and gun were sprinkled over with fine drops of bright red blood. * * * About four hours later * * * it spurted three more streams from its eyes."

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*N. A. Fauna, No. 7, 1893, p. 189.

I myself have observed this strange performance twice, only in these instances the blood was not projected forcibly but trickled down the sides of the lizards' heads.

26.—**Phrynosoma platyrhinos** Girard. DESERT HORNED TOAD.

Phrynosoma platyrhinos, GIRARD, Stansbury's Exped. Gt. Salt Lake, 1853, pp. 361, 363, pl. VII, figs. 1–5 (type locality **Great Salt Lake**); STEJNEGER, N. A. Fauna, No. 7, 1893, p. 190, pl. II, figs. 4a–4c.

Doliosaurus platyrhinos, GIRARD, U. S. Explor. Exped., Herp., 1858, p. 409.

Anota calidiarum, COPE, Am. Nat., XXX, No. 358, Oct., 1896, p. 833 (type locality "**Death Valley, Cal.**" [uncertain]).

Description.—Nostrils opening above lines joining superciliary ridges with end of snout. Head-spines of moderate size or rather short; five to seven temporals, one occipital, and one or two postorbitals, on each side. Three scales in front of occipital horns much larger than other head-shields. Latter usually almost flat, except just in front of occipital and temporal spines, but roughened with small ridges and granulations. Gular region covered with small granular scales, either uniform or with one series of larger scales at each side. Below lower labials, and separated from them by one or two rows of small scales, is a series of large spinose plates which increase in size posteriorly. Two groups of weak spines on each side of neck, lower somewhat larger than upper. Back, tail, and upper surfaces of thighs bearing scattered, slightly elevated, keeled, tubercular scales, with smaller scales and granules between. A single series of peripheral spines, gradually disappearing posteriorly. Tail edged with a row of small spines. Scales on front of the arm large, pointed, and strongly keeled. Those on chest, abdomen, and proximal half of tail smooth. Tympanum usually covered with scales, but sometimes naked. Femoral pores varying from seven to twelve on each side, often invading preanal region. Males with enlarged postanal plates.

The general color of the upper surfaces is white, gray, yellow, brown, or red, variously marbled with black, brown, or slate. A large dark area on each side of the neck is much more distinct in young than in adults. The usual dark dorsal blotches are very indistinct, as are also the dusky cross-bands on the tail. The head is usually dotted with black or brown. The lower surfaces are yellowish white, uniform, or spotted with black, brown, or slate.

Length to anus	30	38	48	77	85	94
Length of tail	14	29	22	40	45	46
Snout to ear	7	8	10	15	16	16
Width of head*	9	12	14	21	22	23
Length of occipital horn	2	2	3	6	8	8
Fore limb	16	19	22	35	34	37
Hind limb	20	25	30	46	48	52
Base of fifth to end of fourth toe	8	9	10	14	15	16

Distribution.—The range of this horned toad in California includes the Colorado and Mojave Deserts of San Diego, Riverside, San Bernardino, and Kern Counties, and the hot, arid portions of the Great Basin. It may, perhaps, be found also in the northeastern corner of the State, for it has been reported from Oregon and is very common on the plains near the Snake River in Idaho. It has not been taken in California anywhere west of the deserts.

It crosses Nevada (Pyramid Lake, Ash Meadows, Amargosa, Vegas Valley, Pahrump Valley, Pahranagat Valley, Indian Spring Valley, Panaca, Grapevine Mts.) to western Utah.

Habits.—Like other species of this genus, *Phrynosoma*

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*To tips of the temporal horns.

platyrhinos feeds upon small insects. These it catches upon the ground and rarely if ever attempts to climb. It cannot run swiftly, but sometimes tries to escape by burying itself in the loose desert soil.

27.—**Phrynosoma m'callii** (Hallowell). FLAT-TAILED HORNED TOAD.

Anota M'Callii, HALLOWELL, Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 182 (type locality "**Great Desert of the Colorado, between Vallicita and Camp Yuma, about 160 miles east of San Diego**"); HALLOW., Sitgreave's Zuni and Colorado Rivers, 1853, p. 127, pl. 10.

Doliosaurus mc'calli, GIRARD, U. S. Explor. Exped., Herp., 1858, p. 408; BAIRD, U. S. Mex. Bound. Surv., Rept., p. 9, pl. 28, figs, 4–6.

Description.—Snout very short, with nostrils opening above continuations of superciliary ridges. Large head-spines; one slender occipital, three to five temporals, and five to seven sublabials, on each side. Sometimes a small interoccipital horn. Scales on upper surface of head slightly convex and nearly smooth, two on occiput being largest. Supralabials small, but projecting, making margin of upper lip serrate. Gular region covered with small, smooth scales, of which one series on each side is slightly enlarged. Below infralabials a series of very large, spinose plates. Two or three small groups of spines on sides of neck. Back, tail, and upper surfaces of thighs bearing scattered, very slightly elevated, weakly keeled, tubercular scales, with small keeled scales or smooth granules between. Two or three series of peripheral spines; those of upper or of middle series largest. Tail greatly flattened and bearing a fringe of thickly set, slender spines. Scales on front of arm large, pointed, and strongly keeled. Those on chest small and smooth, except anteriorly, where larger and keeled. Scales of abdomen small and smooth. Most of lower caudal scales keeled. Tympanum entirely covered with granular scales. Femoral pores arranged, in long series, eighteen or twenty on each side.

The body is ash-color or yellowish olive above, with a narrow median dorsal line of black or dark brown, extending from the occiput to the base of the tail. There is a brown blotch on each side of the neck. Double series of rounded dark spots ornament each side of the back, uniting to form faint cross-bars on the tail. The lower surfaces are silvery or yellowish white.

Length to anus	48
Length of tail	22
Snout to ear	9
Width of head	17
Length of occipital spine	6
Fore limb	23
Hind limb	29
Base of fifth to end of fourth toe	10

Distribution.—The locality in San Diego County at which the original specimen of this species was secured is stated as the Great Desert of the Colorado, between Vallecita and Camp Yuma, about one hundred and sixty miles east of San Diego. I believe that this is the only Californian record of the Flat-tailed Horned Toad.*

Family IV. ANGUIDÆ.

In the lizards of this family, the tongue is formed of a larger, thick, posterior portion, and a smaller, thin, emarginate, anterior part which is more or less retractile into a fold of the posterior portion. The imbricate scales are reinforced with bony plates. In some genera the limbs are well developed, but in others they are rudimentary or even absent. The family is represented in California by a single genus.

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* Yarrow and Henshaw record several specimens from the Mojave Desert as belonging to this species (Surv. W. 100th Mer., Append. NN, 1878, p. 225), but these, doubtless, were really *P. platyrhinos*.

Genus 14. GERRHONOTUS.

Gerrhonotus, WIEGM., Isis, 1828, p. 379; *Abronia*, GRAY, Ann. & Mag. Nat. Hist., I, 1838, p. 389; *Elgaria*, GRAY, l. c., p. 390.

There are four pentadactyle limbs. The head and body are elongate, but shorter than the tail. The head-plates are rather large and change gradually to those of the neck. Interoccipital and azygous prefontal plates are present. The dorsal, caudal, and ventral scales are large, rhomboidal, and arranged in transverse as well as longitudinal series. A band of granules along each side of the body is usually hidden by a dermal fold. The eye is large, with round pupil and well developed lids. The ear-opening is distinct. There is no transverse gular fold. Femoral and preanal pores are absent.

SYNOPSIS OF SPECIES.

a.—Lower temporal scales smooth.

  b.—Dorsal and caudal scales strongly keeled.

    c.—Dorsal scales in fourteen (rarely 14½ or 12½) longitudinal series;[*] interoccipital plate (usually) single; azygous prefrontal large and very broad; belly rarely without gray or slate-colored longitudinal lines, which, when present, run along the middle of each series of ventral plates.[†] .... **G. scincicauda.**—p. 103.

    c^2.—Dorsal scales in sixteen (rarely 15½ or 18) longitudinal series; interoccipital usually represented by two to four small scales; azygous prefrontal usually of moderate size or small; gray or slate-colored longitudinal lines between the series of ventral plates, if present .... **G. burnettii.**—p. 107.

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[*] The scales of the row nearest the granular area vary somewhat in size in different specimens. When counting the dorsal series, the lowest (on each side) should not be included if its scales are less than half the size of those immediately above them. When its scales are half the size of those above, I have called the lowest row ½ series; when more than half the size of those above, a whole series.

[†] Specimens of *G. scincicauda* and *G. burnettii* can usually be recognized at a glance, but the amount of individual variation is so great that it is very difficult to express their characteristics in a key which will serve to distinguish all specimens. It should be remembered that single specimens may vary in one or more of the characters given (except

b^2.—Dorsal and caudal scales weekly keeled.

Dorsal scales in fourteen (or 14$\frac{2}{2}$) longitudinal series; interoccipitals two or three (rarely one); azygous prefrontal of moderate size or small; dark ventral lines between the series of scales, if present; back without complete dark cross-bands . **G. principis**.—p. 112.

a^2.—Temporal scales keeled.

Dorsal scales in sixteen longitudinal series; interoccipital plate single; azygous prefrontal large; back without distinct dark cross-bands .... **G. palmeri**.—p. 113.

28.—Gerrhonotus scincicauda (Skilton). ALLIGATOR LIZARD.

? *Gerrhonotus Weigmannii*, GRAY, Cat. Liz. Brit. Mus., 1845, p. 54 (type locality Mexico?); O'SHAUGHNESSY, Ann. Mag. Nat. Hist. (4), XII, 1873, p. 46.

Tropidolepis scincicauda, SKILTON, Am. Journ. Sci. Arts, (2), VII, 1849, p. 202, pl. at p. 312, figs. 1–3 (type locality Dalles of the Columbia).

Elgaria scincicauda, BAIRD & GIRARD, Stansbury's Exped. Gt. Salt Lake, 1853, p. 348, pl. IV, figs. 1–3; GIRARD, U. S Explor. Exped., Herp., p. 210, pl. XXIII, figs. 1–9.

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the position of the dark ventral lines), which are based upon an examination of 150 specimens. Some of the details of these specimens are:

	scincicauda.	*burnettii*
Number with 12 2-2 scale rows	3	..
" " 14 " "	80	..
" " 14 2-2 " "	3	..
" " 15½ " "	..	4
" " 16 " "	..	59
" " 18 " "	..	1
	86	64
Number with one interoccipital	77	7
" " 2 to 4 "	8	59
" " no "	1	1
	86	63
Number with azygous prefrontal large	82	7
" " " " moderate	4	20
" " " " small	..	34
	86	61
Number without dark lines on belly	2	16
" with dark lines in middle of ventral scale rows	84	..
" " " " at junction " " " "	..	48
	86	64

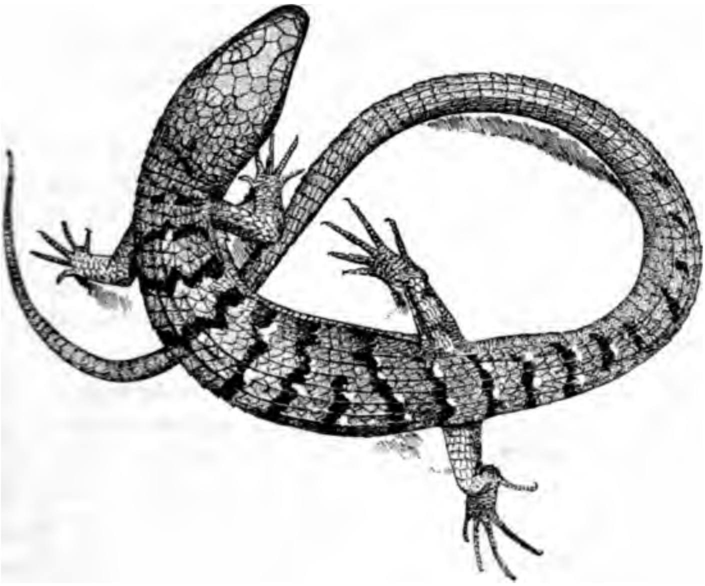
Elgaria grandis, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 176 (type locality Oregon); GIRARD, U. S. Explor. Exped., Herp., p. 212, pl. XXII, figs. 1-8.

Gerrhonotus multicarinatus, YARROW, Bull. U. S. Nat. Mus., No. 24, 1882, p. 47 (part); COPE, Proc. Ac. Nat. Sci. Phila., 1883, pp. 29, 32.

Gerrhonotus cæruleus, BOULENGER, Cat. Liz. Brit. Mus., II, 1885, p. 273 (part).

Gerrhonotus scincicauda, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 195.

Description.—Body long and rather slender, with short limbs and very long tail. Head pointed, with flattened top and nearly vertical sides; its temporal regions often greatly swollen in old specimens. Rostral plate rounded in upper outline. Behind it, on top of the head, a pair of small internasals, a pair of small frontonasals (sometimes absent), a very large azygous prefrontal, a pair of large prefrontals, a long frontal, a pair of frontoparietals, two parietals separated by an interparietal, a pair of occipitals, and a (usually) single interoccipital. Two series (of 5 & 3) supraoculars and a series of small superciliaries. Upper temporal scales usually keeled, but lower two or three series smooth. Upper labials much larger than lower. Below latter two series of large sublabial plates, lower larger. Gular scales smooth and imbricate. Scales on upper surfaces and sides of neck, body, and tail large, rhomboidal, slightly oblique, strongly keeled, strengthened with bony plates, and arranged in both transverse and longitudinal series. Number of longitudinal dorsal series on body fourteen (rarely $12\frac{2}{2}$ or $14\frac{2}{2}$). Number of transverse series between interoccipital plate and backs of thighs varying from forty-one to fifty-two (average in 85 specimens, 47.6). A band of granules along each side from the large ear-opening to the anus, usually hidden by a strong fold.* Ventral plates about size of dorsals, smooth, imbricate, and arranged in twelve longitudinal series. Number of scales between symphyseal plate and anus varying from sixty-two to sixty-eight.



The ground color above, in adults, is olive, brown, yellow, red, or gray, usually paler on the sides and crossed, on the neck and body, by from nine to sixteen continuous irregular black or dark brown bands. These bands are usually of about the width of one row of scales, but are undulate and sometimes more or less diffused on the back. The lateral scales which these bands occupy are tipped with white. Sometimes the tail is marked like the back, but often it bears merely a central row of small brown blotches. The head and limbs may be either unicolor or irregularly mottled with brown. The lower surfaces are white or yellowish, sometimes suffused with pale brown or gray. The abdominal and thoracic regions are rarely without gray or slate-colored lines along the middle of each longitudinal series of scales.

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*This fold often disappears in specimens full of eggs or food.

Young specimens are at first indistinguishable from *G. burnettii* of a similar age, but the complete dorsal cross-bands very soon appear.

Length to anus	41	60	80	114	135	154
Length of tail	83	139	159	226	294	
Snout to ear	10	12	17	23	30	34
Width of head	7	8	11	15	21	28
Head to interoccipital	9	11	14	18	22	25
Fore limb	12	14	20	30	36	40
Hind limb	16	21	27	39	48	53
Base of fifth to end of fourth toe	5	7	10	14	16	17

Distribution.—The Alligator Lizard ranges over the whole length of California, but, I believe, has never been found east of the Sierra Nevada or on the Colorado or Mojave Deserts. In the south it appears to be the only species of the genus, but in the north its range overlaps that of *G. burnettii*, *G. palmeri*, and *G. principis*. Mr. H. W. Henshaw found it on Santa Cruz Island. I have examined specimens from Santa Rosa Island and from Shasta (Redding), Mendocino (Irishes, Fairbanks), Lake (Blue Lakes, Kelseyville), Napa (St. Helena), Sonoma (Santa Rosa), Marin (Lagunitas), Alameda (Calaveras Valley, Livermore, Haywards, Oakland, Berkeley), Santa Clara (Palo Alto, Santa Clara, College Park, Smith Creek, Los Gatos), Santa Cruz (Corralitos, Soquel), Monterey (Pacific Grove), El Dorado (Fyffe 3700 feet, Riverton 4000 feet), Mariposa (near Wawona), Tulare (Three Rivers, East Fork Kaweah), Santa Barbara (Santa Barbara), San Bernardino (Lytle Creek),

Riverside (San Jacinto, Riverside), and San Diego (Carlsbad, Cuyamaca Mountains) Counties, California, and Douglass (Drain) County, Oregon. It seems to be most abundant in the chaparral country, but is by no means confined to this belt.

Habits.—This large and elegantly marked species is rather slow of movement, but its sluggishness is largely due to its lack of timidity, for, if thoroughly frightened, it sometimes runs with great swiftness. It is usually to be seen on the ground, but frequently climbs through the bushes. At such times its long prehensile tail must be very useful. Its food is made up chiefly of insects, such as beetles and flies. Like the following species (*G. burnettii*), the Alligator Lizard is ovoviviparous. Messrs. Doane and Ely brought me a pair which they found mating in a bush near Palo Alto, May 12, 1894. This lizard sometimes bites fiercely when caught, but, like all Californian reptiles excepting the rattlesnakes, is not poisonous.

29.—**Gerrhonotus burnettii** Gray. BURNETT'S ALLIGATOR LIZARD.

?*Gerrhonotus cœruleus*, WIEGM., Isis, 1828, p. 380 (type locality "**Brazil**"[*]); WIEGM., Herp. Mex., 1834, pp. 29, 31; BOCOURT, Miss. Sci. au Mex., Rept., 1878, p. 353, pl. XXIc, figs. 3, 3a; BOULENGER, Cat. Liz. Brit. Mus., II, 1885, p. 273 (part).

Gerrhonotus burnettii, GRAY, "Griff. An. King., IX., Synop. Rept., 1831, p. 64" (type locality "**South America**"); GRAY, Ann. Mag. Nat. Hist., I, 1838, p. 390; GRAY, Beechey's Voy., Zool., 1839, p. 96, pl. XXXI, fig. 2; GRAY, Cat. Liz. Brit. Mus., 1845, p. 54; O'SHAUGHNESSY, Ann. Mag. Nat. Hist. (4), XII, 1873, p. 47; BOCOURT, Miss. Sci. au Mex., Rept., 1878, p. 356, XXIc, figs. 4, 4a; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 197.

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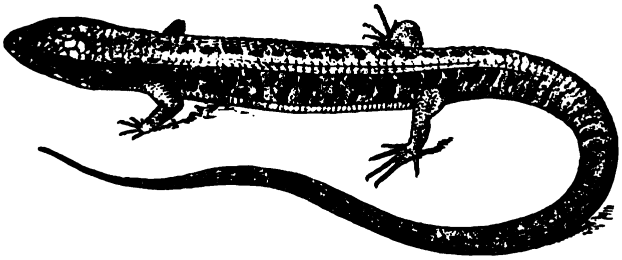
[*] Bocourt quotes from Peters (Miss. Sci. au Mex., 5e liv., p. 355): "Ce Gerrhonote a été rapporté par M. Chamisso, que a fait des collections sur les côtes occidentales des deux Amériques, aussi se pourrait-il qu'il ait été recueilli en Californie, d'où ce voyageur a rapporté divers objets d'histoire naturelle."

Elgaria formosa, BAIRD and GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 175 (type locality California); GIRARD, U. S. Explor. Exped., Herp., p. 206, pl. XXIII, figs. 10–17.

Description.—Body long and rather slender, with short limbs and very long tail. Head pointed, with flattened top and nearly vertical sides, its temporal regions sometimes swollen. Rostral plate large, and rounded in upper outline. Behind it, on top of head, a pair of small internasals, a pair of frontonasals, a small or moderate-sized azygous prefrontal, a pair of prefrontals, a large frontal, a pair of frontoparietals, two parietals with an interparietal between them, and a pair of occipitals separated by from one to four, usually by two or three, interoccipitals. Two series of (5 and 3) supraoculars and a series of small superciliaries. Upper temporal scales usually keeled, but lower two or three series smooth. Upper labials much larger than lower. Below latter, two series of large sublabial plates, lower much the larger. Gular scales imbricate and smooth. Scales on upper surfaces and sides of neck, body, and tail rhomboidal, slightly oblique, strongly keeled, strengthened with bony plates, and arranged in both transverse and longitudinal series. Number of longitudinal series on body sixteen (rarely $14\frac{2}{2}$ or 18). Number of transverse series between occipital plates and back of thighs varying from forty-three to fifty-two (average in 63 specimens, 48.5). A band of granules along each side from large ear-opening to anus, usually hidden by a strong dermal fold. Ventral plates about size of dorsals; smooth, imbricate, and arranged in twelve (or 13) longitudinal series. Number of scales from symphyseal plate to anus varying from fifty-eight to sixty-four.

The ground color above, in adults, is gray, olive, yellow, green, brown, or almost black, with numerous irregular black or dark brown cross-bands, which, however, usually are broken up into two lateral series of vertical bars and one median series of irregular spots or blotches. The ground color of the longitudinal band between the median and lateral dark markings is often lighter than elsewhere. Most of the lateral scales occupied by the dark bars are tipped with white. The coloration of the tail is similar to that of the back. The head and limbs may be either unicolor or irregularly mottled with black or brown. The lower surfaces are white, yellow, green, or gray, often with dark gray or slate-colored lines, which, when present, appear between the longitudinal series of scales.



The young are similarly colored, but the dorsal bands are always broken and the medial spots are much smaller than is usual in adults. The ground color of newly born young is an iridescent bronze.

Length to anus	27	52	76	88	98	99
Length of tail	32	89	126	145	162	172
Snout to ear	7	11	15	17	19	20
Width of head	5	7	11	12	14	14
Head to interoccipital	6	10	12	14	16	16
Fore limb	7	12	18	22	23	24
Hind limb	8	16	24	30	31	33
Base of fifth to end of fourth toe	3	6	8	11	10	12

Distribution.—Burnett's Alligator Lizard occupies, so far as is at present known, merely a narrow strip of country extending along the coast from Monterey to Mendocino County, California.* Parts, at least, of this area it holds in common with its larger congener *G. scincicauda*. I have examined specimens from Mendocino (Irishes), Sonoma (Healdsburg), Marin (Mill Valley), San Francisco (Lake Merced, Presidio), San Mateo (Searsville, Pescadero), Santa Clara (Palo Alto), Santa Cruz (Boulder Creek, Big Trees, Glenwood, Soquel), and Monterey (Pacific Grove) Counties.

Habits.—These slow-moving lizards may easily be caught on the sand hills of San Francisco, where they are very common. They are insect-eaters, feeding chiefly upon beetles. Females usually show little resentment when handled, but males often become very angry and will hiss and bite fiercely, although unable to draw blood. A captive male would hiss and jump at my fingers whenever the door of his cage was opened. The skin is renewed, sometimes at least, twice each year, and, contrary to the method usual among lizards, is shed in a single piece, the animal escaping, as it were, through its own mouth, and neatly inverting its former covering. The tail is strongly prehensile.

The eggs are retained in the body until the young are fully formed. If numerous, the lateral fold gradually disappears as they increase in size. The young are coiled up in a thin, transparent membrane when born. They almost immediately push the snout through this covering by straightening the body and in the course of a few minutes set themselves entirely free. The number of young varies from two to fifteen, but is usually about seven. Two females were caught June 5,

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*I have seen two typical specimens said to have been collected in the Cuyamaca Mts., San Diego Co., but this locality needs confirmation.

1895, and put in small cages, where there were supplied with flies and water, of which these lizards are very fond. Young appeared in one box August 29 and in the other September 24, 1895. Those of the first brood varied in length from seventy-one to seventy-six millimeters, and those of the second, from fifty-eight to sixty-two. The old lizards showed no affection or solicitude for their young, but the young liked to be near their parents. Six out of fifteen inherited an irregularity of the dorsal scale-series, shown by their female parent.*

During the first few days these young lizards ate nothing, but then they began to snap at the smaller flies. When stalking flies, they crouched close to the ground and crept slowly forward, their heads swaying from side to side and their tails quivering or thrashing with excitement. Then, if the snap was successful, the prey was held firmly in the jaws while the lizard, with body and tail straightened, rolled rapidly over and over, grinding the fly in the sand. Frequently when one had caught a fly the others would rush up and feel of it inquisitively with their tongues, sometimes even trying to appropriate it to themselves. Sometimes, too, one's chase was interrupted by another lizard seizing the quivering tip of the hunter's tail. The young lizards were very fond of lying in the water, and several deliberately held their heads under its surface until they were drowned. The last of the family died, May 5, 1896, during a vain endeavor to shed its skin.

The lizards which I kept in confinement were more or less active throughout the winter, but Mr. James M. Hyde broke up two decaying logs, near Pescadero, December 22, 1893, and found five lizards of this species hibernating with five *Sceloporus occidentalis* and one *Eumeces skiltonianus*.

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* I have found a similar irregularity in only two of forty-nine other specimens. One of these was from the same locality as this female.

30.—**Gerrhonotus principis** (Baird & Girard). NORTHERN ALLIGATOR LIZARD.

Elgaria principis, B. & G., Proc. Ac. Nat. Sci. Phila., 1852, p. 175 (type locality **Oregon and Puget Sound**); GIRARD, U. S. Explor. Exped., Herp., p. 214, pl. XXII, figs. 9-16.

Description.—Body long and rather slender, with short limbs and long tail. Head pointed, with flattened top and almost vertical sides, its temporal regions sometimes slightly swollen. Rostral plate large, and rounded in upper outline. Behind it, on top of head, follow a pair of small internasals, a pair of frontonasals, a moderate-sized or small azygous prefrontal, a pair of prefrontals, a long frontal, a pair of frontoparietals, two parietals with an interparietal between them, and a pair of occipitals separated by one or usually two or three interoccipitals. Two series of supraoculars and a series of small superciliaries. Upper temporal scales usually smooth and lower two or three series always so. Upper labials much larger than lower. Below latter, two series of sublabial plates, lower much the larger. Gular scales imbricate and smooth. Scales on upper surfaces and sides of neck, body, and tail large, rhomboidal, slightly oblique, weakly keeled, strengthened with bony plates, and arranged in both transverse and longitudinal series. Number of longitudinal series on body fourteen (rarely $14\frac{2}{2}$ or 16). Number of transverse series between occipital plates and back of thighs varying from forty-four to fifty-three. A band of granules along each side from large ear-opening to anus, usually hidden by a strong dermal fold. Ventral plates about size of dorsals, smooth, imbricate, and arranged in twelve longitudinal series. Number of scales from symphyseal plate to anus varying at least from fifty-six to sixty-two.

The ground color above is olivaceous brown, without cross-bands, but with numerous irregular dark brown spots, which sometimes form longitudinal series. The head and limbs are usually more or less clouded with dark brown. The lower surfaces are yellowish or greenish white, often slightly washed with gray, and with or without slate-colored lines between the longitudinal series of scales.

Length to anus	90	91	96	96	102	105
Length of tail	141		151	139	152	148
Snout to ear	16	17	18	18	19	19
Width of head	12	12	12	12	13	13
Head to interoccipital	14	14	15	15	15	15
Fore limb	21	21	23	22	23	23
Hind limb	28	27	29	29	29	29
Base of fifth to end of fourth toe	10	10	11	10	11	11

Distribution.—The Northern Alligator Lizard is a species of western Washington and Oregon, whose range seems to extend south on the western slope of the Sierra Nevada of California at least as far as Red Point, Placer County.* It may, perhaps, live also in the northwestern corner of the State. I believe that this form will be found to intergrade with both *G. burnettii*, of the coast, and *G. palmeri*, of the southern Sierra Nevada. Northward its range extends to Vancouver Island. It is very abundant near Puget Sound.

31.—Gerrhonotous palmeri (Stejneger). MOUNTAIN ALLIGATOR LIZARD.

Gerrhonotus scincicauda palmeri, STEJNEGER, N. A. Fauna, No. 1893, p. 196 (type locality **South Fork King's River, Calif.**).

Description.—Body long and rather slender, with short limbs and long tail. Head pointed, with flattened top and nearly vertical sides; its temporal regions somewhat swollen. Large rostral plate rounded in upper outline. Behind it, on top of head, follow a pair of small internasals, a pair of small frontonasals, a large azygous prefrontal, a pair of large prefrontals, a long frontal, a pair of frontoparietals, two parietals separated by an interparietal, and a pair of occipitals with one or more interoccipitals between them. Two series (of 5 and 3) supraoculars and one series of small superciliaries. All temporal scales keeled. Upper labials much larger than lower. Below latter, two series of sublabial plates, interior larger. Gular scales imbricate and smooth. Scales on upper surfaces and sides of neck, body, and tail large, rhomboidal, slightly oblique, strongly keeled, reinforced with bony plates, and arranged in both longitudinal and transverse series. Number of longitudinal series on body sixteen. Number of transverse rows between interoccipital plate and backs of thighs varying from forty-two to forty-nine in specimens examined. A band of granules along each side from large ear-opening to anus, usually hidden by a strong dermal fold. Ventral plates about size of dorsals, smooth, imbricate, and arranged in twelve (or 13) longitudinal series. Number of scales from symphyseal plate to anus fifty-nine to sixty-two.

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* The identity of this specimen is not certain. It may, possibly, be an abnormal example of *G. palmeri*.

The ground color above is olive-brown or bluish or greenish drab, usually a little paler laterally than near the middle of the back. There are no definite crossbands, the dark pigments appearing in ill-defined marblings or blotches on the back, or in white-tipped black spots on the sides. The head and limbs are usually unicolor, but may be marked with darker brown. The lower surfaces are yellowish or greenish white, sometimes slightly washed with gray. There are no definite longitudinal lines on the belly in the specimens which I have seen, but two specimens have indications of them between the rows of scales.

Length to anus	37	88	91	98	105	120
Snout to ear	9	19	19	22	23	26
Width of head	6	14	14	17	18	21
Head to interoccipital	8	15	16	18	19	20
Fore limb	10	24	24	25	31	32
Hind limb	14	33	33	37	36	43
Base of fifth to end of fourth toe	5	12	12	14	14	15

Distribution.—The Mountain Alligator Lizard has been found only at high altitudes (5,000 to 9,000 feet) on the western slope of the Sierra Nevada of Tuolumne, Mariposa, Fresno, and Tulare Counties, and at a slightly lower level (Fyffe 3,700 feet) in El Dorado County. It has been recorded from various localities along the Kern, Kaweah, and King's Rivers and is common in the Yosemite Valley.

Habits.—This species is common near the Little Kern River. Here it hides behind the loose bark of the great pines. Like other members of the genus, it usually moves slowly and seems to have much curiosity. Near the Yosemite Valley it mates about the middle of June.

Family V. ANNIELLIDÆ.

This family, which is confined to California, contains a single genus of strongly degraded lizards. The body is cylindrical and snake-like, without strongly marked neck or tail. There are no external traces of limbs, but a rudimentary pelvis remains. The tongue is thick, with a thinner, smooth, deeply notched anterior portion. The teeth are few, but large and curved. Thin osteodermal plates are present.

Genus 15. ANNIELLA.

Anniella, GRAY, Ann. & Mag. Nat. Hist. (2), X. p. 440 (type **pulchra**).

The scales are small, smooth, imbricate, and rather soft; the dorsals, laterals, ventrals, and caudals nearly equal-sized. The ears are entirely concealed and the eyes partially so. The tail is very blunt and ends in a round plate. The preanal scales are numerous. The head-plates are few and large. The nasal extends to or almost to the labial margin, the first labial appearing on the lower surface of the lip.

SYNOPSIS OF SPECIES.

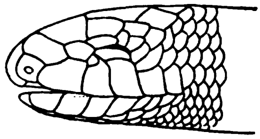
a.—Color above drab or silvery gray or yellowish white, with three or more black or brown lines........................A. pulchra.—p. 116.

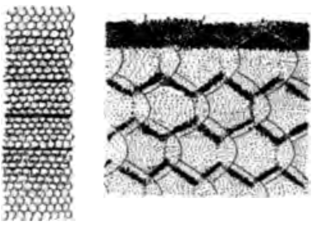
a².—Color above black or blackish brown, with or without dark longitudinal lines.................................A. nigra.—p. 118.

32.—**Anniella pulchra** Gray. SILVERY FOOTLESS LIZARD.

Anniella pulchra, GRAY, Ann. Mag. Nat. Hist. (2), X, 1852, p. 440 (type locality **California**); "GRAY, Zool. Herald, p. 154, pl. XXVIII"; BOCOURT, Miss. Sci. au Mex., p. 460, pl. XXII*G*, fig. 2; BAUR, Proc. U. S. Nat. Mus., XVII, 1894, p. 345.

Description.—Head slightly depressed, rather short, scarcely distinct from neck even in old examples where temporal regions have become swollen. Snout projecting beyond lower jaw. Rostral plate very large and strongly recurved on top of snout, where separated from frontal by a pair of large prefrontals. Behind large frontal, a single very broad frontoparietal, its posterior margin notched to receive a small interparietal with which it frequently unites. On each side of interparietal, a small parietal, and behind these usually two small occipitals separated by an interoccipital. A large supraocular precedes several smaller plates. A large preocular with, usually, a smaller one below it. Nasal large and extending to margin of lip, but small first supralabial plate may be seen below it. Second supralabial largest. Symphyseal large, followed by several pairs of large sublabials. Infralabials smaller than supralabials. Dorsal, ventral, lateral, and caudal scales all similar, slightly largest on tail and smallest on neck, strongly imbricate, rounded in posterior outline, and perfectly smooth. Preanal scales slightly enlarged. Number of longitudinal series of scales around body varying from twenty-four to thirty-four.





The color above is yellowish white or silvery or drab-gray, with one distinct longitudinal brown line down the middle of the back and one or more similar lines along each side. Very narrow brown zigzag lines usually run along the margins of the other series of dorsal scales. These lines are sometimes quite yellowish, sometimes nearly black. The lower surfaces are yellowish white, frequently suffused with brown, slate, or gray on the chin, throat, and tip of tail, and often showing narrow zigzag longitudinal lines. The entire upper surface of a specimen from San Bernardino is slightly suffused with olive-gray.

Length to anus	84	97	125	130	143	146
Length of tail	44	59	70	74	89	96
Width of head	4	4	5	5	6	6
Head to interparietal	4	5	5	5	5	6
Diameter of body	4	5	5	7	7	7

Distribution.—The most northern localities from which I have obtained specimens of this lizard are San Ardo, in the interior of Monterey County, and Bear Valley, in San Benito County. It doubtless occurs in many parts of the San Joaquin Valley, where it has been taken in Tulare County. Farther south it has been found at San Bernardino, and is very common near San Jacinto, Riverside County, and in the western portion of San Diego County.

Habits.—The habits and food of the Footless Lizard or "Silver Snake" are the same as those of *Anniella nigra.*

33.—**Anniella nigra** Fischer. BLACK FOOTLESS LIZARD.

Anniella nigra, FISCHER, Abh. Nat. Verein Hamburg, IX, 1, 1885 (1886), p. 9 (type locality **San Diego, California**).

Description.—Head very slightly depressed, short, and scarcely distinct from neck. Snout projecting beyond lower jaw. Rostral plate very large and strongly recurved on top of snout, separated there from frontal by a pair of large prefrontals. Behind large frontal, single very broad frontoparietal, its posterior margin notched to receive a small interparietal with which it sometimes unites. On each side of interparietal, a small parietal, and behind these usually two small occipitals separated by an interoccipital. One large and one or more small supraoculars and a series of small superciliaries. Large preocular with a smaller one below it. Nasal large and extending to margin of lip, but a small first supralabial may be seen below it. Second supralabial largest. Symphyseal large, followed by several pair of large sublabials. Infralabials smaller than supralabials. Dorsal, lateral, ventral, and caudal scales all similar, slightly largest on tail and smallest on neck, strongly imbricate, rounded in posterior outline, and perfectly smooth. Preanal scales slightly enlarged.

Number of longitudinal series of scales around body not differing from *Anniella pulchra*.

The entire upper surface is deep blackish brown, with or without indistinct lines of darker brown or black corresponding in position with those of *A. pulchra*. The chin, throat, and the tip of the tail are suffused with dark brown. The rest of the lower surface is yellowish white, sometimes with narrow brown zigzag lines between the longitudinal series of scales.

Length to anus	117	137	148	149	149	161
Length of tail	17*	68	26*	17*	17*	20*
Width of head	5	5½	6	6	7	7
Head to interparietal	4	5	5	6	6	6
Diameter of body	5	6	7	7	8	8

If the type of *A. nigra* really came from San Diego it is doubtful if this form is worthy of recognition. However, it seems best to retain it here, because all the numerous black specimens which I have seen were collected on the coast of Monterey County, where no specimen of the light form has been found.

Distribution.—Pacific Grove, Monterey County (and "San Diego, California"?).

Habits.—The Black Footless Lizard burrows in the soil of the pine forest at Pacific Grove. It is sometimes found under stones or boards, but travels swiftly under the surface of the loose soil. An examination of the contents of several stomachs has shown its food to consist of large insect larvæ (more than 1¼ inches long), and two small ground dwelling beetles (*Helops* and *Platydema*). Mr. Harold Heath, of Stanford University, has found this lizard to be ovoviviparous.

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* Reproduced ??

Family VI. HELODERMATIDÆ.

This family contains the only lizards which are known to be poisonous. There is but a single genus, with two species. The tongue is large, deeply divided at tip, smooth anteriorly but villose posteriorly. The teeth differ from those of other lizards in being grooved. There are large poison-glands under the chin. The limbs are well developed. The skin of all the upper surfaces is covered with large tubercles which often ossify. The belly is provided with squarish plates. Usually there are no femoral or preanal pores, but one specimen has a single preanal pore of great size.

Genus 16. HELODERMA.

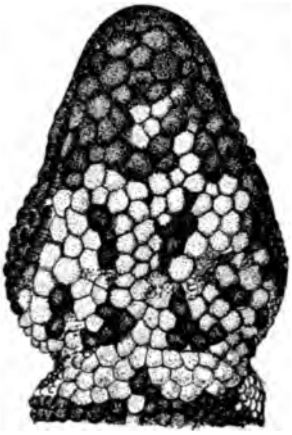
Heloderma, Wiegm., Isis, 1829, p. 624 (type **horridum**).

There are four pentadactyle limbs. The head is covered with irregular, convex, bony plates, which often coössify with the skull. The back and sides are provided with more or less regular rows of tubercles similar to those on the head. The ventral plates are arranged in transverse series. The eye has well developed lids and a round pupil. The ear-openings are large. One strong and usually one or more weaker gular folds are present.

34.—Heloderma suspectum Cope. GILA MONSTER.

Heloderma suspectum, COPE, Proc. Ac. Nat. Sci. Phila., 1869, p. 5 (type locality **Sonoran Region**); SHUFELDT, Proc. Zool. Soc. Lond., 1890, p. 148; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 194.

Description.—Head and body depressed, large, heavily built, with short limbs and tail. Upper surface of head broad, flat, and covered with large, irregular, convex, bony tubercles. Snout rounded. Temporal regions swollen. Nostrils large, opening laterally between three plates. Eye rather small. Ear-opening large, elliptical, oblique, and overhung by temple. Rostral and symphyseal plates large. A pair of internasals. Three pair of plates behind symphyseal. Gular region and fold with small round or oval, convex, or flattened tubercles, changing gradually into the plates of the belly. Body, limbs, and tail covered above and laterally with nearly equal-sized, round, smooth, convex tubercles separated by granules. Lateral tubercles passing gradually into smooth, flat, squarish plates in transverse rows on lower surfaces of body and tail. Digits with transverse plates above and below. A pair of enlarged plates in front of anus.



Probably no two specimens show just the same pattern of coloration. The top of the head, the body and limbs are variously marbled, banded, or reticulated with orange or salmon and black or brown. The chin, throat, snout, and sides of head are usually of the dark color with few if any orange or salmon-colored tubercles. The markings on the tail frequently form transverse bars or rings. The belly is orange or salmon and black or brown, tessellated.

Length to anus	220	270	288	295	315	345
Length of tail	101	125	140	145	146	150
Snout to ear	36	46	53	57	53	58
Width of head	31	43	50	49	49	52
Fore limb	62	78	80	83	87	93
Hind limb	66	74	90	88	95	98
Base of fifth to end of fourth toe	18	20	23	25	25	25

Distribution.—The Gila Monster has been found in the Valley of the Virgin, about eight miles below Bunkerville, near the eastern boundary of Nevada. It may be that it occurs on portions of the deserts of southeastern California, but as yet no specimens from this area have found their way into museums.

Habits.—The Gila Monsters are the only lizards whose bite is known to be poisonous. The venom is secreted by large glands situated just under the chin, and flows out, onto the floor of the mouth, between the lips and the gums. Being below the teeth and not directly communicated to them, the poison sometimes fails to find its way into a wound although the teeth are grooved to afford it a passage. The upper jaw of the Monster is provided with a saliva which possesses no poisonous properties. This harmless saliva appears to be present in the lower jaw as well as the upper, but is there mixed with venom about as deadly as that of the rattlesnakes. Although provided with so powerful a poison, the Gila Monster is so gentle and sluggish that it is not always easy to cause one to bite, but when thoroughly angered it bites fiercely, throwing its head to one side with lightning-like quickness and holding like a bull-dog to whatever it has seized. Sumichrast says that it turns onto its back before biting. Although this observation has not been confirmed, the presence of venom in the lower jaw only would explain such an action. In spite of its clumsy form it sometimes climbs bushes, probably in search of bird's eggs, which, together with young rabbits, etc., form its food.

Family VII. XANTUSIIDÆ.

This family contains but three genera; one Central American, one West Indian, and one Californian. The eyes are without lids. The head is covered with large shields. The upper surface of the body is granular or tubercular, but the lower is provided with plates. The tongue is broad, plicate, with tip indistinctly notched. The ear-opening is large. Femoral pores are present.

Genus 17. XANTUSIA.

Xantusia, BAIRD, Proc. Ac. Nat. Sci. Phila., 1858, p. 255 (type **vigilis**); *Zablepsis*, COPE, Am. Nat., XXIX, 1895, p. 758 (type **henshawi**); *Amœbopsis*, COPE, l. c., p. 758 (type **gilberti**).

The dorsal granules are uniform. Superciliary and sometimes supraocular plates are present. The interparietal is separated from the frontal by the frontoparietal plates. The pupil is vertically elliptic. There are two or three transverse gular folds, the last edged with enlarged plates.

SYNOPSIS OF SPECIES.

- a.—One series of small plates (superciliaries) over eye.
  - b.—Ventral plates in twelve longitudinal series; yellow or brown with dark spots on single granules........... **X. vigilis.**—p. 123.
  - b².—Ventral plates in fourteen longitudinal series; irregularly marbled with yellow lines enclosing large dark brown spots. **X. henshawi.**—p. 128.
- a².—Two series of small plates (superciliaries and supraoculars) over eye; ventral plates in sixteen longitudinal series. . **X. riversiana.**—p. 130.

35—Xantusia vigilis Baird. DESERT NIGHT LIZARD.

Xantusia vigilis, BAIRD, Proc. Ac. Nat. Sci. Phila., 1858, p. 255 (type locality **Fort Tejon, California**); STEJNEGER, N. A. Fauna, No. 7, 1893, p. 198, pl. III, figs. 1a–1c.

Description.—Body nearly cylindrical, with very short limbs. Upper surface of head flattened, curving towards snout. Three folds on throat, anterior connecting ears and encircling head. Nostril opening at junction of rostral, internasal, postnasal, and first labial plates. Rostral in contact with first labial and internasal plates. Two internasals followed by a large subhexagonal frontonasal. Behind this, two prefrontals (in contact), bordered posteriorly by single broad frontal and first superciliary plates. Each of two frontoparietal plates forming sutures with frontal, second, third, and fourth superciliaries, first supratemporal, parietal, interparietal, and its fellow of opposite side. Parietals and very large interparietal bordered behind by two large occipitals. A row of small supratemporal scutes along outer edge of occipital and parietal plates. Two large loreals in contact below with superior labials and above with frontonasal and prefrontal plates. A large postnasal in front of first loreal. A series of small plates, upper of which are superciliaries, usually surrounding eye. Between this ring and larger loreal, two or three small plates. Four or five superior and three or four inferior labials to a point below middle of eye. Eye large, without lids, with vertical pupil. Its diameter contained about twice in distance from end of snout to orbit. Oblique ear-opening with a very weak anterior denticulation. Inferior labials in contact with large sublabials. First pair of latter in contact on median line. Back, sides, upper and posterior surfaces of limbs, and gular regions, covered with subhexagonal granules. A series of large plates along edge of last gular fold. Ventrals quadrate, in twelve longitudinal and twenty-seven to thirty transverse series. Large preanal plates arranged in two rows of two each, sometimes surrounded by a few smaller scales or granules. Tail conical and covered with whorls of smooth, narrow, and transversely convex scales; its length very variable. Six to ten femoral pores forming a series along each thigh.

The ground color in different specimens varies from smoke gray, through many shades of yellow and brown, to clove brown. Scattered granules are dark brown or black. At times these dark granules are so numerous as to become confluent, with a tendency to form longitudinal lines. In other individuals they are scarcely visible. Some specimens have heavy dotting on a very pale ground; in others the dotting is heavy on a dark ground; many show faint dots on a light ground; and several have few dots on a dark ground. A yellowish line usually runs back on the neck from the outer edge of each occipital plate. Two similar lines may sometimes be seen above these. The lower parts are creamy white, sometimes clouded with brown toward the sides. The young average much darker than the adults.

Length to anus	22	37	42	44	47
Length of tail	24	41	61	47	40*
Shielded part of head	6	9	9	9	10
Snout to ear	5½	8	8	8½	9
Snout to anterior gular fold	5½	8	8	8½	9
Snout to posterior gular fold	9	13	14	15	15
Fore limb	7	10¾	11	11	12
Hind limb	9½	15	15½	16	17
Base of fifth to end of fourth toe	4	5½	5¾	6	6½

Distribution.—The Desert Night Lizard is the most abundant of its class in the territory it has chosen for its home. It seems to be peculiarly dependent upon the presence of tree yuccas. These weird plants grow in each of the localities from which the lizard has been recorded, viz.: Fort Tejon in the Cañada de las Uvas, Kern County, and Hesperia, San Bernardino County, California, and Pahrump Valley, Nevada.

Dr. Charles H. Gilbert and the writer collected specimens near Mojave, Kern County, and found a portion of a cast skin at Victor, San Bernardino County, in November, 1893. In September of the following year, the writer found this species common at Mojave and Hesperia, and secured a single specimen near Cabazon on the eastern slope of San Gorgonio Pass, Riverside County, California. The first three of these localities are situated in the great *Yucca-arborescens* belt, which extends along the southwestern edge of the Mojave Desert. The last is in a small and apparently isolated grove of smaller tree yuccas, seemingly of another species.

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* Regrown.

Habits.—About a mile from the station at Mojave there is a considerable forest of *Yucca arborescens.* The many trees and wind-broken branches, which lie decaying on the ground, afford a home to numerous colonies of white ants, scorpions, vicious looking black spiders, and several species of beetles. In a deep crack of one of these branches a small lizard was discovered, which, when caught, proved to be a young *Xantusia vigilis.* Probably it had not yet learned how to hide from the day, for I have never seen another undisturbed individual.

The key to their home once discovered, the collection of a large series of these lizards was merely a matter of physical exertion. Every fourth or fifth stem that was examined gave up its *Xantusia*, and in one instance five, as many as were previously known to collections, were found under a single tree.

Most of the lizards were found between the bark and the ground, but many had hidden in the thick clusters of dead leaves, from which it was very difficult to dislodge them. When first exposed to the light, they were dark colored and seemed dazzled for a moment, during which they made no attempt to escape. They were not at all sluggish, however, and, if not caught immediately, made for the nearest cover as fast as their very short legs would permit. This cover was often the collector, and the little lizards either hid under his shoes, or climbed his legs, sometimes even reaching his shoulders. They showed no desire to enter the numerous holes in the ground about them, or to escape by burrowing. Put into a glass bottle they become very light colored in a few minutes, but began to turn dark again immediately after sundown. Young specimens were numerous and remained dark longer than adults. Many fragments of cast skins were found, but never a whole skin in one place. The stomachs of several individuals contained the wings of some small dipterous insect, the elytra of a little brown beetle, and some small white bodies which resembled spider's eggs.

Several specimens were taken alive to the Leland Stanford Junior University and kept for some months in a large glass jar in which some fine sand and pieces of wood and bark had been placed. At first, they ventured out from their retreat only at dusk unless disturbed, but after a few days they seemed to become more restless, and, urged perhaps by hunger, showed themselves many times each day. At night, when they were always more active, they often climbed to the top of a piece of yucca stem placed upright in the middle of their cage. No desire to burrow was observed. All declined to show any interest in the small beetles and flies, both dead and living, which were placed in the jar, and they finally became greatly emaciated.

Mojave was visited again in the fall of the following year. The specimens were all caught alive and put into a large glass bottle, but were soon killed by the heat, although care was taken to keep them in the shade as much as possible. Count was kept as the lizards were put in the bottle and showed later that several more were taken out than had been put in. This may have been due to a mistake in the record, but was more probably caused by the birth of young after capture. The adults were afterwards carefully examined and three were found to contain young, showing that the species is ovoviviparous. One of the three contains two fetuses, the others have one each. The fetal specimens are about the size of the young found under the dead branches. They were taken on the seventeenth and eighteenth of September.

36.—**Xantusia henshawi** Stejneger. HENSHAW'S NIGHT LIZARD.

Xantusia henshawi, STEJN., Proc. U. S. Nat. Mus., XVI, 1893, p. 467 (type locality **Witch Creek, San Diego County, California**); VAN DENBURGH, Proc. Cal. Ac. Sci. (2), V, 1895, p 530.

Zablepsis henshavii, COPE, Am. Nat., XXIX, 1895, pp. 758, 860.

Xantusia picta, COPE, Am. Nat., XXIX, 1895, pp. 859, 939 (type locality "**Tejon Pass, California**").

Description.—Body greatly depressed, with very short limbs. Upper surface of head very flat. Three folds on throat. Nostril opening in a small scute at junction of rostral, internasal, postnasal, and first labial plates. Rostral broad and rather low, bounded by first labial, nasal, and internasal plates. Two internasals followed by a large subquadrate frontonasal, sometimes divided longitudinally; behind this, two prefrontals, bordered posteriorly by broad frontal and first superciliary plates. Each of two frontoparietal plates in contact with frontal, second, third, and fourth superciliaries, first supratemporal, parietal, interparietal, and its fellow of opposite side. Parietals and interparietal bordered behind by two large occipitals. One or more interoccipitals sometimes present. A row of small supratemporals along outer edge of occipital and parietal plates. Two large loreals, in contact below with superior labials and above with frontonasal and prefrontal plates. Eye surrounded by a series of small plates, upper five of which are superciliaries. Between this ring and larger loreal two small plates. Five superior and three inferior labials to a point below pupil. Eye large, without lids, and with vertical pupil. Its diameter contained about twice in distance from end of snout to orbit. Ear-opening with a very weak anterior denticulation. Symphyseal plate very long. Inferior labials in contact with large sublabials. First pair of latter in contact on median line. Back, sides, upper, and posterior surfaces of limbs, and gular regions, covered with subhexagonal granular scales. A series of large quadrate plates along edge of last gular fold. Ventrals quadrate, in fourteen longitudinal and thirty-three or thirty-four transverse rows. Preanal plates arranged in three or four rows, the two medial plates of posterior series being largest. Tail conical, somewhat depressed at its base and covered with whorls of smooth scales, which are very narrow and transversely convex. Eight or ten femoral pores forming a series along each thigh.

The ground color above is broccoli brown. On this are numerous large irregular blotches of very dark seal brown, between which run more or less continuous lines of pale yellow. The upper surfaces of the limbs and head are similarly, but less distinctly, marked. The tail is yellow with irregular blotches and half rings of blackish seal brown. The lower surfaces are uniform yellowish white.

Length to anus	57	63	65
Length of tail	66	69	83
Shielded part of head	12½	14	13
Snout to ear	12	13	
Snout to anterior gular fold	12	13	
Snout to posterior gular fold	20	21	
Fore limb	10	16	
Hind limb	26	27	
Base of fifth to end of fourth toe	9½	10	

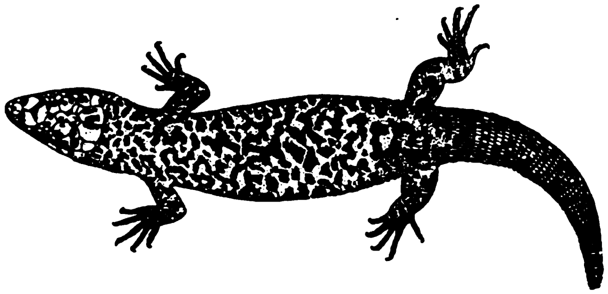
Distribution.—Henshaw's Night Lizard has been found at Witch Creek, San Diego County, California. This locality is in the chaparral belt, at an "altitude of about 2,700 feet." The specimen described by Prof. Cope as *X. picta* is said to have been collected in Tejon Pass, but this locality needs confirmation.

Habits.—This species lives among the granite boulders and comes out into the narrower crevices between them a few minutes before dark. It is, therefore, practicable to hunt for it only about fifteen or twenty minutes each day. If a bit of string or straw be introduced into the domain of one of these lizards it will often be seized, the reptile apparently mistaking it for some stray insect.

37.—**Xantusia riversiana** Cope. ISLAND NIGHT LIZARD.

Xantusia riversiana, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 29 (type locality **California**); RIVERS, Am. Nat. XXIII, 1889, p. 1100 (type locality stated as **San Nicolas Island**); COPE, Proc. U. S. Nat. Mus., 1889, p. 147.

Description.—Limbs very short and body somewhat depressed. Upper surface of head very flat. Nostril pierced in a small scute at junction of rostral, internasal, postnasal, and first labial plates. Rostral broad and rather low, bounded by first labial, nasal, and internasal plates. Two internasals followed by a large hexagonal frontonasal. Behind this two prefrontals, bordered posteriorly by broad frontal and first superciliary and first supraocular plates. Each of two frontoparietal plates in contact with frontal, second, third, and fourth supraoculars, parietal, interparietal, and its fellow of opposite side. Interparietal bordered behind by two large occipitals. Latter separated from the parietals by two small scutes. A row of large supratemporals along outer edge of occipital and parietal plates. Two loreals in contact below with supralabials and above with frontonasal and prefrontal plates. Eye surrounded by a series of small plates, upper five of which are superciliaries. Between this ring and posterior loreal, two or three small plates. A series of four supraoculars separating superciliaries from frontal and frontoparietal plates. Five superior and four or five inferior labials to a point below pupil. Eye large, without lids, and with vertical pupil. Ear with a weak anterior denticulation. Inferior labials in contact with large sublabials. First pair of latter in contact on median line. Back, sides, upper and posterior surfaces of limbs, and gular regions, covered with flattened granules. A series of large plates along edge of last gular fold. Quadrate ventrals in sixteen longitudinal and thirty-two to thirty-five transverse rows. Large preanal plates arranged in two or three series, edged by smaller scales and granules. Tail conical,



covered with whorls of smooth, narrow, and transversely convex scales. A series of from ten to twelve femoral pores along each thigh.

The ground color is smoke gray or cinnamon, with numerous irregular maculations of dark brown or black. These markings are much smaller and less numerous on the lower surfaces. There is considerable variation in the color pattern. One specimen has two narrow parallel black lines, originating at the posterior edge of each occipital plate and running the whole length of the back. The space between each pair of these lines is unmarked, but the rest of the upper surface is irregularly spotted. Other specimens offer an almost perfect imitation of coarse granitic rock.

Length to anus	106
Length of tail	73*
Shielded part of head	24
Snout to ear	24
Snout to anterior gular fold	20
Snout to posterior gular fold	34
Fore limb	30
Hind limb	38
Base of fifth to end of fourth toe	14

Distribution.—This largest species of the group has been recorded from San Nicolas, Santa Catalina, and San Clemente Islands, California.

Family VIII. TEIIDÆ.

This family contains a large number of American lizards of various forms and scaling. They are most closely related to the *Lacertidæ* of the Old World. The tongue is slender and ends in two long smooth points. The head is covered with large, regular plates (except in the South American *Callopistes*). An ear-opening is usually present. Eyelids are rarely wanting. Femoral and preanal pores may be either present or absent. The limbs are rudimentary in some members of the group. Two genera have been found in California.

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* Reproduced.

SYNOPSIS OF GENERA.

a.—Two frontoparietal plates ....Cnemidophorus.—p. 133.
a^2.—One frontoparietal plate ....Verticaria.—p. 140.

Genus 18. CNEMIDOPHORUS.

"*Cnemidophorus*, WAGLER, Syst. Amph., 1830, p. 154 (part)."

There are four pentadactyle limbs. The head-plates are large, except the occipitals, which are small and irregular. There are two frontoparietal plates. The back and sides are covered with small, smooth, granular scales. The ventral plates are large and arranged in both transverse and longitudinal series. The legs and tail are very long; the latter, slender and provided with large scales, which are keeled above but smooth below. The eye has well developed lids and a round pupil. Large ear-openings are present. One strong and several weaker folds cross the throat. Femoral pores are present.

SYNOPSIS OF SPECIES.[*]

a.—Markings on sides of head not well defined, almost obsolete; throat often suffused with slate or gray......C. tigris.—p. 134.
a^2.—Markings on sides of head very distinct and well defined; throat not (sometimes slightly in *C. stejnegeri*) suffused with gray or slate.

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[*] Prof. Cope has described (Trans. Am. Philos. Soc., (2), XVII, 1892, p. 40, pl. IX, fig. 8) *Cnemidophorus septemvittatus* from a specimen said to have been collected by Dr. Boyle in El Dorado County, Cal., and now deposited in the United States National Museum. The registers of this museum state, in Prof. Baird's handwriting, that the number 2872, attached to this *Cnemidophorus*, belongs to two specimens of *Sceloporus*. These *Scelepori*, properly numbered, are still on the museum shelves, and it therefore seems probable that the type and only known specimen of *Cnemidophorus septemvittatus* is not of Californian origin, but has been so labeled through an erroneous duplication of museum numbers.

It may be readily distinguished from the three *Cnemidophori* known to be Californian by the presence of enlarged plates on the posterior surface of its forearm.

b.—Spots on throat few and small: central gular and collar scales smaller.............................**C. tigris undulatus.**—p. 137.

b^2.—Spots on throat numerous and large, often forming irregular transverse bands; central gular and collar scales larger.
C. stejnegeri.—p. 139.

38.—Cnemidophorus tigris Baird & Girard. DESERT WHIPTAIL.

? *Ameiva tessellata*, SAY, Long's Exped. Rocky Mts., 1823, II (Philadelphia) p. 50 (London) p. 351, note 33 (type locality **Arkansas River near Castle Rock Creek***).

Cnemidophorus tigris, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p, 69 (type locality **Valley of Great Salt Lake, Utah**); BAIRD & GIRARD, Stansbury's Report Gt. Salt Lake, p. 338, pl. II; BAIRD, U. S. Mex. Bound. Surv., 1859, II, p. 10, pl. XXXIII; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 198.

Cnemidophorus gracilis, BAIRD & GIRARD, Proc. Ac. Nat, Sci. Phila., VI, 1852, p. 128 (type locality **Desert of Colorado, Cal.**); BAIRD, U. S. Mex. Bound. Surv., 1859, II, p. 10, pl. XXXIV, figs. 7-14.

Cnemidophorus tessèlatus, BAIRD, Pac. RR. Surv., X, pt. IV, p. 18.

Cnemidophorus tessellatus tessellatus, COPE, Trans. Am. Philos. Soc. (2), XVII, pt. 1, 1892, p. 34, pl. VII.

Description.—Snout long, with nearly vertical sides. Nostrils opening in large anterior nasal plates; latter in contact on top of snout. Posterior nasal forming sutures with anterior nasal, first, second and third labials, loreal, prefrontal, and frontonasal plates. Loreal in contact with third and fourth labials, first subocular, preocular, first superciliary, prefrontal, posterior nasal, and sometimes first supraocular plates. Four supraoculars, first and fourth smaller than others. Second, third, and fourth supraoculars separated from superciliaries by small convex granules. Similar granules intrude between third and fourth supraoculars and frontoparietal and parietal. Occcipitals represented by from two to four transverse series of small plates behind parietals and interparietal. About five superior and six inferior labials to a point below middle of eye. Sublabials large and, except first, separated from infralabials by small granules and plates. Anterior gulars largest centrally, becoming gradually smaller laterally and anteriorly, and changing rather abruptly to smaller posterior gulars. Central gular and collar scales a little smaller than in *C. stejnegeri*. Scales on center of collar of moderate size, those on its edge smaller. Small, smooth, convex granules on back usually slightly larger than in *C. stejnegeri*. Eight longitudinal rows of ventral plates. From three to six large scutes, surrounded by smaller plates and granules, in front of anus. Posterior surface of forearm covered with small, nearly equal-sized granules. Tail very long and provided with rings of large, obliquely keeled scales. Femoral pores varying from eighteen to twenty-three.

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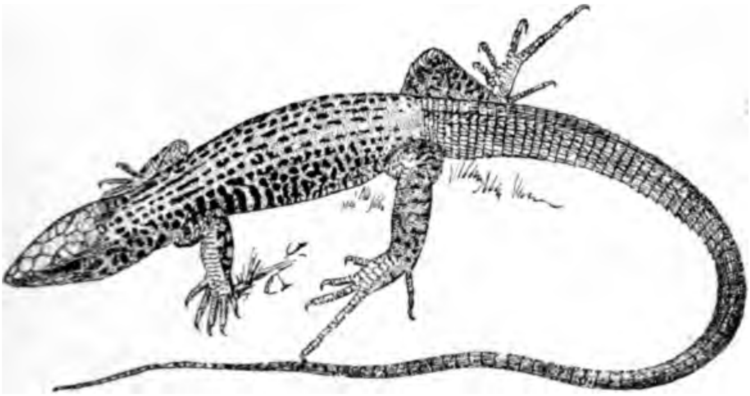
* Colorado.



The color above is brownish, yellowish, or bluish gray, becoming paler toward the tail and darker on the sides, with very irregular dark and light marblings. In young specimens there are narrow light longitudinal lines separated by darker bands, which are more or less broken up by spots of the same color as the lines. In older specimens these lines have become more or less obscure, and in some specimens the upper surface is nearly unicolor. The upper surfaces of the limbs are similarly colored. The dark markings on the sides of the head and neck and on the gular region are small and ill defined. The tail is gray or brown, often with dark lines along the keels of its upper scales. All the lower surfaces are creamy white, usually suffused with gray or slate on the gular region or chest, and maculated with black.

Length to anus	47	61	82	83	92	93
Length of tail	124	184	190	207	204	212
Snout to ear	11	15	19	20	20	22
Snout to interparietal	10	12	16	15	16	17
Width of head	7	9	11	12	12	14
Fore limb	17	24	29	31	32	32
Hind limb	34	47	56	56	61	65
Base of fifth to end of fourth toe	16	23	25	25	28	29

Distribution.—The Desert Whiptail Lizard or "Swift Jack" is common in many parts of the Mojave and Colorado Deserts and the Great Basin, but does not range farther west. It has been taken in Owen's, Coso, Death, Panamint, and Deep Spring Valleys, in Inyo County; at Mojave, in Kern County; Barstow, The Needles, Leach Point Valley, and Warren's Wells, in San Bernardino County; and Fort Yuma, in San Diego County, California. Its range extends across Nevada (Pahrump Valley, Oasis Valley, Pahranagat Valley, vicinity Reno) to southern Idaho (Plains near Snake River) and western Utah (Santa Clara and Great Salt Lake Valleys).

Habits.—This species lives on the open desert, over which it runs with great swiftness. The sand banks near The Needles are covered with its tracks, which end in the holes made by small mammals. So far as I have been able to learn, its food consists entirely of insects.

39.—**Cnemidophorus tigris undulatus** (Hallowell). CALIFORNIA WHIPTAIL.

Cnemidophorus undulatus, HALLOWELL, Proc. Ac. Nat. Sci. Phila., VII, 1854, p. 94 (type locality "**Fort Yuma, San Joaquin Valley,**" [=**Fort Miller, Fresno County, Calif.**]); HALLOW., Rept. U. S. Pac. R. R. Surv., X, pt. IV, 1859, p. 8, pl. IX, fig. 2.

Cnemidophorus tigris undulatus, STEJNEGER, N. A. Fauna, No. 7, p. 200.

Description.—Whole animal long and slender. Nostrils opening in large anterior nasal plates; latter meeting on top of snout. Posterior nasal forming sutures with anterior nasal, first, second and third labials, loreal, prefrontal, and frontonasal plates. Loreal in contact with third and fourth labials, first subocular, preocular, first superciliary, prefrontal, posterior nasal, and first supraocular plates. Four supraoculars, first and fourth smaller than others. Second, third, and fourth supraoculars separated from superciliaries by small convex granules. Similar granules between third and fourth supraoculars and frontoparietal and parietal plates. Behind parietals, two or three transverse series of small occipitals. About five superior and six inferior labials to a point below pupils. Sublabials large, and, except first, separated from infralabials by small plates and granules. Anterior gulars largest centrally, becoming gradually smaller laterally and anteriorly, and changing abruptly to smaller posterior gulars. Largest gular and collar scales averaging smaller than in *C. stejnegeri*. Scales on center of collar moderately large, those on its edge smaller. Back covered with small, smooth, convex granules slightly larger than in *C. tigris*. Ventral plates in eight longitudinal rows. Several large plates, surrounded by smaller plates and granules, in front of anal opening. Posterior surface of forearm covered with small, nearly equal-sized granules. Long slender tail provided with rings of large, obliquely keeled scales. Femoral pores varying in number from eighteen to twenty-three.

The back is grayish or yellowish brown with about seven or nine wavy black longitudinal bands or rows of spots which are sometimes broken up into irregular marblings. On the sides of the head and neck are numerous, large, well defined black blotches. The limbs are marbled with black. The tail is yellowish or olive-brown, darkest along the keels of the upper scales. The lower surfaces are creamy or buffy white, often spotted or blotched with black; the markings on the gular region being few and usually very small.

Length to anus	79	79	87	99	103	105
Length of tail		207	204	242	252	231
Snout to ear	18	18	19	23	22	24
Snout to interparietal plate	15	15	15	18	18	19
Width of head	11	11	12	16	13	15
Fore limb	29	29	30	33	35	36
Hind limb	59	58	64	68	71	73
Base of fifth to end of fourth toe	30	28	30	31	32	32

Distribution. — The California Whiptail Lizard replaces *C. tigris* in the northern, as *C. stejnegeri* does in the southern, portion of California west of the desert. Its range seems to be continuous with that of *C. tigris* through Walker and Tehachapi Passes and the Cañada de las Uvas, and thence extends north on the lower levels of the western slope of the Sierra Nevada at least as far as Mariposa County. West of the San Joaquin and Sacramento Valleys, it has been found at Los Gatos, in Santa Clara County, and at Kelseyville, in Lake County.

Habits.—Very little is known of the habits of this lizard. When hard pressed, it often tries to elude pursuit by burrowing, although it can run very swiftly. It mates, near Los Gatos, early in June.

40.—Cnemidophorus stejnegeri Van Denburgh. STEJNEGER'S WHIPTAIL.

Cnemidophorus stejnegeri, VAN DENBURGH, Proc. Cal. Ac. Sci. (2), IV, Pt. I, 1894, p. 300 (type locality between San Rafael and Ensenada, Lower California, Mex.).

Description.—Body long, with a very slender tail and very long legs. Nostrils opening in large anterior nasal plates; latter in contact on top of snout. Posterior nasal forming sutures with anterior nasal, first, second, and third labials, loreal, prefrontal, and frontonasal plates. Loreal in contact with third and fourth labials; first subocular, preocular, first superciliary, prefrontal, posterior nasal, and sometimes first supraocular plates. Four supraoculars, fourth smallest. Second, third, and fourth supraoculars separated from superciliaries by small convex granules. Similar granules between third and fourth supraoculars and frontoparietal and parietal. One to three transverse series of small occipitals behind parietals and interparietal. About five superior and five or six inferior labials to a point below pupil. Sublabials large and, except anteriorly, separated from infralabials by small granules and plates. Anterior gulars largest centrally, becoming gradually smaller laterally and anteriorly, and changing rather abruptly to smaller posterior gulars. Central gular and collar scales averaging larger than in *C. tigris* and *C. t. undulatus*. Scales on center of collar larger than those on its edge. Back covered with small, smooth, convex granules, usually slightly smaller than in *C. tigris* and *C. t. undulatus*. Ventral plates in eight longitudinal rows. From two to five large plates, surrounded by smaller plates and granules, in front of anus. Posterior surface of forearm covered with small, nearly equal-sized granules. Tail long, provided with rings of large, obliquely keeled scales. Femoral pores varying from nineteen to twenty-five on each thigh.

The color above is yellowish or grayish brown, becoming grayer toward the head and paler on the sides, with seven or nine undulate black bands or longitudinal rows of irregular spots. The upper surfaces of the limbs are brown or gray reticulated with black. On the sides of the head and neck are numerous large, well defined black blotches. The tail is yellowish or olive-brown, darkest along the keels of its upper scales. The lower surfaces are yellowish white, rarely faintly washed with gray, usually much spotted or blotched with black; the markings on the gular region being numerous and large, often forming irregular cross-bands.

Length to anus	73	89	91	93	96	98
Length of tail	119	229		212	247	252
Snout to ear	17	21	21	20	23	23
Snout to interparietal	14	17	17	17	18	18
Width of head	10	13	13	12	15	15
Fore limb	26	31	30	30	31	33
Hind limb	53	60	58	60	63	68
Base of fifth to end of fourth toe	25	28	26	27	29	30

Distribution.—Stejneger's Whiptailed Lizard inhabits the western slope of the coast ranges of San Diego, Riverside, and San Bernardino Counties (Santa Ysabel Valley, Witch Creek, Julian Mountains, Clogston's Valley, San Jacinto, Hemet Valley, Lytle Creek), and probably will be found also in parts of Orange and Los Angeles Counties, California.

Habits.—Unknown, but, doubtless, similar to those of *Cnemidophorus tigris undulatus.*

Genus 19. VERTICARIA.

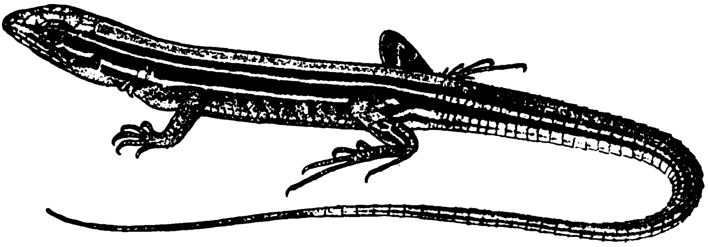
Verticaria, COPE, Proc. Amer. Philos. Soc., XI, 1869, p. 158 (type **hyperythra**).

There are four pentadactyle limbs. The head-plates are large, except the occipitals, which are small and irregular. The frontoparietal plate is single. The back and sides are covered with small, smooth granules. The ventral plates are large and are arranged in both transverse and longitudinal series. The tail is very long and slender and is provided with large scales, which are keeled on its upper surface but smooth below. The eye has well developed lids and round pupil. A large ear-opening is present. One strong and several weaker folds cross the throat. Long series of femoral pores are present.

41.—**Verticaria hyperythra beldingi** (Stejneger). BELDING'S ORANGE-THROAT.

Verticaria hyperythra, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 32.
Verticaria beldingi, STEJNEGER, Proc. U. S. Nat. Mus., XVII, 1894, p. 17 (type locality **Cerros Island, Lower California, Mex.**).
Verticaria hyperythra beldingi, VAN DENBURGH, Proc. Cal. Ac. Sci. (2), V, 1895, p. 131.

Description.—Nostrils opening in large anterior nasal plates, which meet on top of snout. Posterior nasal forming sutures with anterior nasal, first, second, and sometimes third labials, loreal, prefrontal, and frontonasal plates. Loreal in contact with third, fourth, and (usually) second labials, first subocular, preocular, first superciliary, (often) first supraocular, prefrontal, and posterior nasal plates; sometimes divided into a larger anterior and smaller posterior portion. Three or four supraoculars; first in contact with superciliary, prefrontal, and frontal plates; others separated from superciliaries and parietal, and usually from frontoparietal, frontal, and first supraocular, by small granular scales. A single large frontoparietal plate separating frontal from interparietal and parietals. One or two transverse rows of small occipital plates. About five superior and as many inferior labials to a point below middle of eye. Large sublabial plates present. Gulars large centrally, becoming smaller anteriorly and laterally, and changing abruptly to smaller granules posteriorly. Scales on fold or collar usually large, largest being along its edge. Eight longitudinal rows of ventral plates. Back and sides covered with small, smooth, equal-sized granules. Limbs plated in front and below. Rings of large scales, strongly keeled except on the proximal part of its ventral surface, covering tail. Ear-opening large, without denticulation. About thirteen to sixteen pores in a series along each thigh.



The back is black or brown, darkest in young speci mens, sometimes dotted with gray, with three longitudinal light lines on each side. The lower two of these lines are wider and lighter than the upper one. The lowest line is continued along the side of the head and thigh. Near its base the tail is banded like the back, but it becomes unicolor toward the tip. It is bright campanula blue in young specimens, but this color disappears with age. The lower surfaces are yellowish white, often tinted with gray or bluish slate on the belly, more or less washed with bright reddish orange-chrome in adult males.

Length to anus	31	36	59	61	65	68
Length of tail	65	77	98*	132*	166	147*
Snout to ear	8	8	13	14	14	15
Snout to interparietal plate	6½	7	10	11	11	12
Width of head	5	5	8	8	8	9
Fore limb	11	12	19	20	20	22
Hind limb	22	23	37	42	41	46
Base of fifth to end of fourth toe	10	11	17	19	19	20

Distribution.—Belding's Orange-throated Lizard has been found in California only in the western parts of San Diego and Riverside Counties (San Diego, Mexican border between Campo and the coast, Oak Grove, between Oceanside and San Jacinto, San Jacinto, Riverside), but ranges for some distance down the peninsula of Lower California.

Habits.—At San Jacinto this lizard lives on rocky hillsides, is very shy, and quickly retreats to holes when approached.

Family IX. SCINCIDÆ.

The tongue is slightly notched at its tip. The head is covered with large, regular plates. The scales on the body and tail are moderately large, imbricate, and reinforced with an armor of bony plates. The eyes have round pupils and well developed lids. Femoral pores are absent. Limbs may be either present or absent. An interoccipital plate is rarely present.

A single genus represents this family in California.

Genus 20. EUMECES.

Eumeces, Wiegm., Herp., Mex., 1834, p. 36 (part); *Plestiodon*, Dum. & Bibr., Erpét. Gen., V, 1839, p. 697; *Lamprosaurus*, Hallow., Proc. Ac. Nat. Sci. Phila., 1852, p. 206 (type **guttulatus**); "*Eurylepis*, Blyth, Journ., As. Soc. Beng., XXIII, 1854, p. 739."

The limbs are four, pentadactyle. The dorsal, lateral, caudal, and ventral scales are thin, smooth, and strongly imbricate. A distinct ear-opening is present. Gular and lateral dermal folds are absent. The tail is moderately long.

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*Reproduced.

SYNOPSIS OF SPECIES.

a.—Light lines persistent, the upper pair separated by two and two half rows of scales; head never red.......... **E. skiltonianus.**—p. 144.

a^2.—Light lines present in young only, upper pair separated by not more than two rows of scales; head bright red in adults. **E. gilberti.**—p. 147.

42.—**Eumeces skiltonianus** (Baird & Girard). WESTERN SKINK.

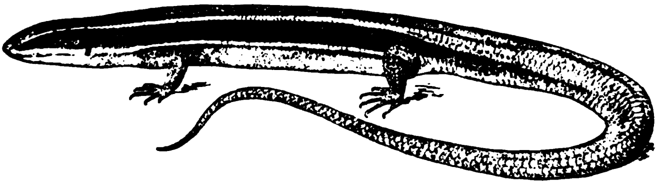
Plestiodon skiltonianum, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 69 (type locality **Oregon**); BAIRD & GIRARD, Stansbury's Exped. Gt. Salt Lake, 1853, p. 349, pl. IV, figs. 4–6.

Eumeces quadrilineatus, HALLOWELL, U. S. Pac. R. R. Surv., X, 1859, Pt. IV, p. 10, pl. IX, fig. 3 (type locality near **Mojave River and in San Bernardino Valley, southern California**).

Eumeces skiltonianus, COPE, Bull. U. S. Nat. Mus., No. 1, 1875, p. 45. YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 41; STEJNEGER, N. A. Fauna, No. 7, 1893, p, 201.

Eumeces hallowellii, BOCOURT, Miss. Sci. au Mex., Rept., 6e, livr., 1879, p. 435, pl. XXII E, fig. 7 (type locality **California**).

Description.—Body long and rounded, with long tail and short legs. Nasal scute small, in contact with internasal, postnasal, first labial, and rostral plates. Postnasal touching nasal, internasal, anterior loreal, and first and second labial plates. Anterior loreal forming sutures with postnasal, internasal, (usually) frontonasal, prefrontal, posterior loreal, and second and third labials. Posterior loreal larger than anterior and bordered behind by two preoculars and first superciliary. Four large supraoculars, first three touching long frontal. Interparietal larger than either frontoparietal, but very narrow posteriorly and sometimes not separating parietals. Parietals very large and followed by one or two pair of wide occipitals. Temporal plates very large. Upper labials seven or eight in number, last largest. Symphyseal very broad and followed by one or two wide azygous sublabials (postmentals), and several large, paired sublabials in contact with infralabials. All scales on body, limbs, and tail similar in shape, very smooth, and strongly imbricate. Lower caudals of median series greatly enlarged transversely. Upper caudals about size of dorsals, larger than laterals, ventrals, and gulars. Twenty-four or twenty-six rows of scales encircling middle of body. Ear-opening about size of a gular scale and feebly denticulated anteriorly.



The color above is black or dark olive, with two bluish gray or pale brown lines along each side. The upper of these lines originates at the internasal plate, crosses the anterior loreal, prefrontal, supraocular, and parietal plates, and runs along the dorsal scales of the second and third rows from the median line to, and often for some distance along, the tail. The lower traverses the upper labial plates, crosses the ear-opening, and continues along the side of the neck and body to the hind limb, often reappearing on the tail. The ground color is usually darkest near the light lines. The upper pair of the latter are separated by about two and two half rows of scales. The limbs are olive, sometimes marked with darker brown on the margins of the scales: The bands of the back are continued for a varying distance on the tail, which is elsewhere greenish bluish, or grayish slate in adults, bright cobalt blue in young. The lower surfaces are yellowish white, often clouded with blue or slate on the belly and throat.

In very old specimens the ground color becomes paler and the lines widen and sometimes almost disappear.

Length to anus	29	41	55	60	64	66
Length of tail	40	69	105	117	113	120
Snout to ear	7	8	11	11	12	12
Snout to occipital plates	6	8	10	10	11	11
Fore limb	7	10	15	14	16	15
Hind limb	10	14	22	21	23	23
Base of fifth to end of fourth toe	4	6	9	8	9	9

Distribution.—The Western Skink, Skilton's Skink, or Blue-tailed Lizard, is more widely distributed in California than any other saurian. It probably ranges over the entire State, except the lower, dryer portions of the Colorado and Mojave Deserts and San Joaquin Valley. It has been found in San Diego (San Diego, Cuyamaca Mountains), Riverside (San Jacinto), Los Angeles (Los Angeles), San Bernardino (Mojave River), Santa Barbara (Santa Barbara), Inyo (Argus and Panamint Mountains), Kern (Fort Tejon, Kern River), Tulare (White River, Trout Meadows), Fresno (Fresno), El Dorado, Placer (Red Point), Shasta (Pitt River, Baird), Siskiyou (Fort Jones), Lake (Kelseyville), Sonoma (Healdsburg), Napa (Napa), Marin (Larkspur), Alameda (Berkeley, Oakland), San Mateo (Pescadero), Santa Clara (Palo Alto, College Park, Mountain View, Black Mountain, Alum Rock Cañon, Smith Creek, Mt. Hamilton, Los Gatos), Santa Cruz (Big Basin, Boulder Creek, Corralitos), and Monterey (Monterey) Counties, California.

This species lives also in western Oregon (Willamette Valley), and probably will be found in Washington.

Habits.—This lizard seems to be most abundant in damp places, such as are found throughout the redwood forests of the Coast Range. Here it is usually found under decaying logs or behind the loose bark of old stumps. It is rather slow of movement and may easily be caught with the hands. Its food consists of insects. Vegetable matter is sometimes found in its stomach but is the food of caterpillars eaten by the lizard.

43.—**Eumeces gilberti** Van Denburgh. RED-HEADED SKINK.

Eumeces gilberti, VAN D., Proc. Cal. Ac. Sci. (2), VI, 1896, p. 350 (type locality **Yosemite Valley, Mariposa County, California**).

Description.—Body long and rounded, with long tail and short legs. Nasal plate small, in contact with internasal, postnasal, first labial, and rostral. Postnasal touching nasal, internasal, anterior loreal, and first and second labial plates. Anterior loreal forming sutures with postnasal, internasal, frontonasal, prefrontal, posterior loreal, and second and third labials. Posterior loreal larger than anterior and bordered behind by two preoculars and first superciliary. Four large supraoculars, first three touching long frontal. Interparietal larger than either frontoparietal, but narrower than usually in *E. skiltonianus*, and often not separating parietals. Parietals very large and followed by one or two pair of wide occipitals. Temporals very large. Upper labials eight in number, eighth largest. Symphyseal very broad and followed by two wide azygous sublabials and several large, paired sublabials in contact with infralabials. All scales on body, limbs, and tail similar in shape, very smooth, and strongly imbricate. Median series of lower caudals greatly enlarged transversely. Upper caudals about size of dorsals, larger than laterals, ventrals, and gulars. Twenty-four or twenty-six rows of scales encircling middle of body. Ear-opening about size of an abdominal scale and feebly denticulate anteriorly. In old specimens of this skink, as in other species, the temporal regions become more or less swollen.

The adult is brownish olive above, slightly bronzed, or faintly washed with red, without traces of longitudinal lines. The dorsal scales are edged with darker brown, and often, especially toward the tail, show central spots of verdigris green. The tail is greenish or grayish yellow. The limbs are colored like the back. The entire head and more or less of the neck are bright poppy red slightly tinged with carmine. This color is brightest just behind the ear-opening, sometimes slightly mixed with olive on top of the head. The lower surfaces, behind the red of the throat, are dull yellowish white.

The head and back of the smallest specimen are dark seal brown, darkest on the margins of the scales, with four longitudinal light lines. The lower line on each side is indistinct, hardly to be distinguished from the coloration of the ventral surfaces, except between the ear and the fore limb. The upper pair of light lines are broader than in *E. skiltonianus* and are separated by only two rows of scales. They are white only on the head, being overlaid with bronze posteriorly. The limbs are olive, darkest on the margins of the scales. The tail is bluish gray with some bronze and greenish tints near its base. The lower surfaces are creamy white, grayish on the belly.

A somewhat larger specimen (second in table of measurements) is sepia above, with traces of the upper pair of light lines on the neck but disappearing about fifteen millimeters behind the head. The red of the head is just beginning to appear around the ear-opening. The lower surfaces are grayish white.

Length to anus	52	64	81	81	84	96
Length of tail	66	119	142	136		158*
Snout to ear	10	12	15	15	15	19
Snout to occipital plates	9	11	13	13	14	16
Fore limb	12	17	20	21	20	25
Hind limb	18	24	29	30	30	34
Base of fifth to end of fourth toe	7	10	11	11	11	13

Distribution.—The Red-headed Skink is known only from the western slope of the Sierra Nevada, California.† In the vicinity of the Yosemite Valley, it has been taken on the floor of the Yosemite Valley, at Inspiration Point, Yosemite Valley, at an altitude of about 4,500 feet on the Yosemite road four miles from Wawona, and between Groveland and Crocker's. Farther north it has been found at Big Trees, Calaveras County, and at Sugar Loaf (5,000 feet), El Dorado County.

Habits.—This lizard is common in the mountains near the Yosemite Valley and is well known to the hotel keepers and ranch men. It is often seen in grass and among rocks, retreating swiftly to holes under stones and boulders when frightened. It seems to be much more active than the Western Skink. Were it not for the different position of the light stripes of the young and the fact that this form seemingly does not occur in most parts of the range of *E. skiltonianus*, *Eumeces gilberti* might be regarded as a color phase of the Western Skink.

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*Reproduced.

†Dr. Stejneger's "*E. skiltonianus*" from Kern River and Fort Tejon (N. A. Fauna, No. 7, 1893, p. 202) may, perhaps, belong here.

Suborder II. SERPENTES—Snakes.

Family X. LEPTOTYPHLOPIDÆ.

There are no large plates on the belly, the body being covered everywhere with uniform scales. The head is very small and continuous with the neck. The nasal plate reaches the margin of the lip. The eye may be seen through the ocular plate. One or two large plates precede the anus. The tail ends in a small spine. A pelvic girdle is present, but there are no external traces of limbs. The lower jaw is toothed.

The small blind snakes belonging to this family are similar in appearance to the *Typhlopidæ* of the Old World and tropical America, but differ in several structural features.

Genus 21. SIAGONODON.*

"*Siagonodon*, PETERS, Sitzb. Ges. naturf., Freunde, 1881, p. 71" (type **septemstriatus**).

The body is cylindrical, covered with smooth, cycloid scales. The rostral plate is very large, and is recurved on both the upper and lower surfaces of the protruding snout. The nasal plate is very large; behind it is the large ocular, followed in turn by wide parietal and occipital plates. A row of small scales runs along the top of the head behind the rostral plate. No supraocular plates are present. The preanal plate is not divided.

A single species represents this family in California.

44.—**Siagonodon humilis** (Baird & Girard). WORM SNAKE.

Rena humilis, B. & G., Cat. N. A. Reptiles, I, Serpents, 1853, p. 143 (type locality **Valliecitas, Cal.**); STEJNEGER, Proc. U. S. Nat. Mus., XIV, 1891, p. 501; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 203.

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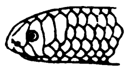
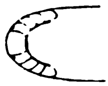
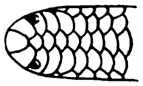
* The type of *Rena* is *R.* (=*Leptotyphlops*) *dulcis* B. & G.

Glauconia humilis, BOULENGER, Cat. Snakes Brit. Mus., I, 1893, p. 70.

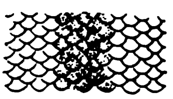
Description.—Body long and slender, with short, blunt tail bearing a small spine at its tip. Head small, continuous with neck, slightly depressed, with prominent, rounded snout. Rostral plate strongly recurved on top of snout and continued back on lower surface of head to mouth. A large nasal plate bordering lip and divided behind, and sometimes in front of, nasal opening. Ocular plate reaching margin of lip between two labials. Two large plates, parietal and occipital, behind ocular. No supraocular plate. Nasal, ocular, parietal, and occipital plates separated from corresponding plates on opposite side of head by a single series of small, rounded, imbricate scales. Scales on chin smallest. Fourteen rows of very strongly imbricate scales around middle of body; middle ventral series often slightly enlarged. Preanal plate single. Caudal scales similar to those on body.







The entire upper surface, five to seven longitudinal rows of scales, is brown, sometimes slightly grayish at the edges of the scales. The lower parts are creamy white, rarely clouded with gray.



Length to anus	91	98	133	199	235	272	291
Length of tail	4	4	7	10	9	9	11
Width of head	2	2	2	3	4	4	4
Width of middle of body	2	2	2½	4	5	5	6

Distribution.—In California, this little snake has been found only at Yuma and Vallecita, San Diego County, and in Death Valley, Inyo County. It probably occupies most of the intervening desert regions. Boulenger records a specimen from San Bernardino.

Family XI. BOIDÆ.

The belly is provided with a series of large plates. The head may be covered with either small scales or large plates. The eye is well developed, with vertical pupil. Rudimentary pelvis and hind limbs are present, the latter usually showing externally as a small spur on each side of the anus. Both jaws bear teeth.

Two genera of boas have been found in California.

SYNOPSIS OF GENERA.

a.—Head covered with small scales; tail not very blunt.
Lichanura.—p. 152.

a².—Head with large plates above; tail very blunt.
Charina.—p. 154.

Genus 22. LICHANURA.

Lichanura, COPE, Proc. Ac. Nat. Sci. Phila., 1861, p. 304.

The head is slightly distinct from the neck and is covered with small scales. The nostril is between two plates, the anterior of which meets that of the opposite side on the median line. The scales on the body are smooth and nearly as wide as long. The urosteges and preanal plate are undivided. The short tail is tapering, but ends in a rounded plate.

45.—Lichanura roseofusca Cope. CALIFORNIA BOA.

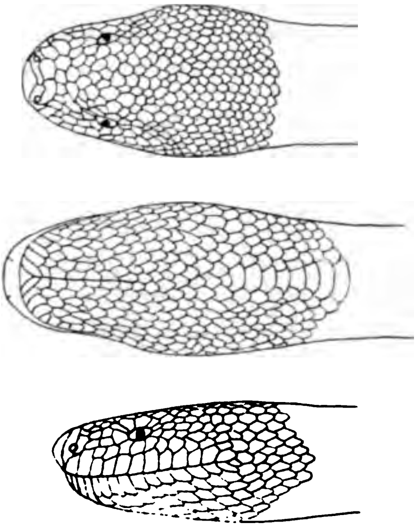
Lichanura roseofusca, COPE, Proc. Ac. Nat. Sci. Phila., 1868, p. 2 (type locality **northern Lower California**); STEJNEGER, U. S. Nat. Mus., XIV, 1891, p. 514; COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 591.

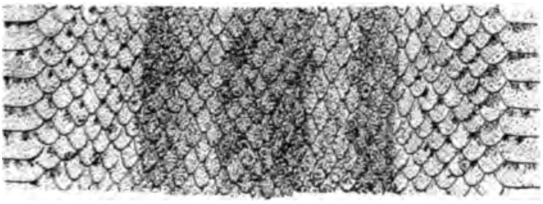
Lichanura myriolepis, COPE, Proc. Ac. Nat. Sci. Phila., 1868, p. 2 (type locality **northern Lower California**); STEJNEGER, Proc. U. S. Nat. Mus., XII, 1889, p. 98.

Lichanura orcutti, STEJNEGER, Proc. U. S. Nat. Mus., XII, 1889, p. 96, fig. 1 (type locality **Colorado Desert, San Diego County, California**); STEJNEGER, Proc. U. S. Nat. Mus., XIV, 1891, p. 513–515; COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 592.

Lichanura simplex, STEJNEGER, Proc. U. S. Nat. Mus., XII, 1889, p. 97, fig. 2 (type locality **San Diego, Cal.**).

Description.—Top of head nearly flat, covered with small, smooth scales. Snout long, with a more or less prominent high rostral plate. Anterior labials very high, but their tips sometimes cut off and appearing as small scales below loreals. Loreals usually three, but their number not at all constant. Seven to ten scales encircling eye. Scales on the body smooth, imbricate, nearly as wide as long and arranged in from thirty-five to forty-three longitudinal rows, lowest row on each side formed of larger scales. Gastrosteges narrow and varying in number from two hundred and twenty-four to two hundred and forty-one. From thirty-nine to forty-seven urosteges. Spurs small, but easily seen at each side a little in front of anus.





The color above is light bluish or brownish gray or deep drab, with or without three more or less indefinite reddish or yellowish brown longitudinal bands. The middle of one of these bands originates between the eyes, while the others arise on the temples. All or none of these bands may extend to or along the tail. The lower surfaces are yellowish white, more or less spotted or blotched with brown or gray.

Length to anus	370	518*	695*	765*	860*	870*
Length of tail......................	48	66	90	80	117	110

Distribution.—This northern relative of the great boas of tropical America has been found, in California, only in San Diego (San Diego, Colorado Desert, Bonsall), Riverside (San Jacinto), San Bernardino (Cucamonga Cañon, San Gabriel Mts.), and Los Angeles (Mt. Wilson) Counties. It lives also in Arizona and northern Lower California.

Genus 23. CHARINA.

"*Charina*, GRAY, Cat. Snakes Brit. Mus., 1849, p. 113 (type bottæ);" *Wenona*, B. & G., Proc. Ac. Nat. Sci. Phila., 1852, p. 176; "*Pseudoeryx*, JAN, Arch. f. Nat., 1862, p. 242" (type bottæ).

The head is not, or is very slightly, distinct from the neck and is provided with large plates. The nostril is between two plates. The scales on the body are smooth, small, imbricate, and about as long as wide. The urosteges and preanal plate are undivided. The tail is short, very blunt, ending in a large, rounded plate.

46.—**Charina bottæ** (Blainville). RUBBER SNAKE.

Tortrix bottæ, BLAINV., Nouv. Ann. Mus., IV, 1835, p. 289, pl. XXVI, fig. 1-1b (type locality California).

Charina bottæ, GRAY, Cat. Spec. Snakes Brit. Mus., 1849, p. 113; BOCOURT, Miss. Sci. au Mex., 8e livr., 1882, p. 511; STEJNEGER, Proc. U. S. Nat. Mus., XIII, 1890, p. 181; COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 592.

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*From Stejneger, Proc. U. S. Nat. Mus., XIV. 1891, p. 515.

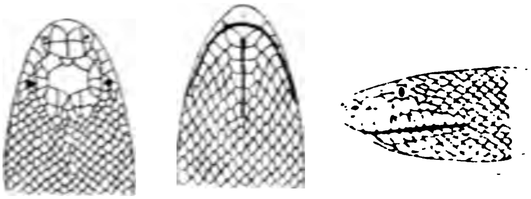
Wenona isabella, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1852, p. 176 (type locality Puget Sound); Girard, U. S. Explor. Exped., 1858, p. 113, Atlas, pl. VII, figs. 8–14.

Wenona plumbea, Baird & Girard, Proc. Ac. Nat. Sci Phila., 1852, p. 176 (type locality Puget Sound); B. & G., Cat. N. A. Reptiles, I, 1853, p. 139; Girard, U. S. Explor. Exped., Herp., 1858, p. 112, Atlas, pl. VII, figs. 1–7; Bocourt, Miss. Sci. au Mex., Rept., 8e livr., 1882, p. 512, pl. XXX, figs. 7–7c.

Charina plumbea, Cope, Proc. Ac. Nat. Sci. Phila., 1861. p. 305; Townsend, Proc. U. S. Nat. Mus., X, 1887, p. 240; Stejneger, Proc. U. S. Nat. Mus., XIII, 1890, p. 181; Stejneger, N. A. Fauna, No. 7, 1893, p. 203.

Charina brachyops, Cope, Proc. U. S. Nat. Mus., XI, 1888, p. 88, pl. XXXVI, figs. 2a–2f (type locality Point Reyes, Cal.); Stejneger, Proc. U. S. Nat. Mus., XIII, 1890. p. 181; Cope, Proc. U. S. Nat. Mus., XIV, 1891, p. 592; Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 131.

Description.—Top of head very slightly rounded, covered with plates which often differ greatly in size, shape, and number in different individuals. Rostral plate very large. Between it and broad frontal, two or three pair of plates—anterior nasal, internasal, and prefrontal. Labial and prefrontal plates sometimes entering orbital ring. A single loreal usually present, but sometimes two or none. Anterior upper labials usually very high, but, like all head-plates, subject to much variation.* Scales on body smooth, imbricate, about as wide as long, and arranged in from thirty-nine to forty-nine longitudinal rows, lowest row on each side being formed



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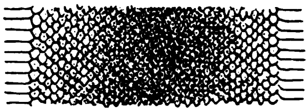
* For an account of the scale variation in this genus, see Stejneger, Proc. U. S. Nat. Mus., XIII, 1890, pp. 177-182.

of larger scales. Gastrosteges narrow and ranging in number from one hundred and ninety-two to two hundred and eleven. From twenty-nine to thirty-nine urosteges; usually all single, but sometimes a few divided. Anal spurs small but distinct. Tail very short and nearly as blunt as head.



All the upper and lateral surfaces are grayish, yellowish, or greenish brown, without dark or light markings. The chin and throat are sometimes clouded with gray or brown. The rest of the lower surface is yellowish white.

Four young, from Placer County, are dull buff both above and below.

Length to anus	193	238	356	408	482	519
Length of tail	26	31	47	58	58	73

Distribution.—The Rubber Snake, or Two-headed Snake as it is often called because of its blunt tail, is not rare in the moister portions of California. It has been taken in Siskiyou (near Mount Shasta), Lassen (Eagle Lake), Placer (Red Point, Tahoe City), Mariposa (Yosemite Valley), Fresno (Fresno), Tulare (Redwood Cañon, East Fork Kaweah River), Humboldt (Humboldt Bay), Marin (Point Reyes, Mt. Tamalpais), Alameda (Temescal, Oakland), San Francisco (Presidio), San Mateo (Halfmoon Bay), Santa Clara (Palo Alto, Black Mountain), and Santa Cruz (Big Basin, Soquel) Counties, California; and in Oregon (John Day River, Summer Lake, Willamette Valley), Washington (Puget Sound), Nevada (Humboldt River), and Idaho (Kootenai County).

Habits.—This little snake is most abundant in moist places, such as are found in the redwood forests of the

Coast Range. It is slow of movement and very gentle. When handled, it usually ties itself into a curious ball-like knot—whence its common name—but, like *Lichanura*, never tries to defend itself by biting. A female caught in June contains large eggs.

Family XII. COLUBRIDÆ.

This family contains a large number of snakes in which the belly is covered with a series of large plates; the head-plates are large and more or less regular; the eye is always well developed, but its pupil may be either round or elliptical; there are no rudiments of limbs or pelvis; both jaws are toothed, without poison-fangs near the front of the mouth.

SYNOPSIS OF GENERA.

- a.—Scales smooth.
  - b.—Anal plate divided; urosteges in two series.
    - c.—Loreal plate absent.
      - d.—Anterior nasal united with internasal, sometimes meeting its mate on top of the snout; rostral prominent, greatly depressed; scales in thirteen rows............**Chilomeniscus.**—p. 158.
      - d^2.—Internasal distinct, anterior nasal not extending onto top of head; rostral slightly prominent, not depressed; scales in fifteen rows.......................**Tantilla.**—p. 176.
    - c^2.—Loreal plate present.
      - e.—Pupil round.
        - f.—Rostral not free at edges.
          - g.—Fourth infralabial largest; nasal plates usually more or less united; preoculars normally one; temporals 1-2.
            - h.—Snout high, not pointed in profile. **Contia.**—p. 161.
            - h^2.—Snout depressed, pointed in profile. **Chionactis.**—p. 159.
          - g^2.—Fifth (rarely 4th or 6th) infralabial largest; nasals distinct*; preoculars normally two.
            - i.—Temporals 1-1; frontal little longer than wide; a narrow white or yellow collar across nape. **Diadophis.**—p. 164.

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* Rarely united above the nostril in *Diadophis*.

i².—Temporals 2-2 (rarely 1-1 or 2-3); frontal much longer than broad; no single, definite, light collar on neck .... Bascanion.—p. 183.

f².—Rostral large, with free lateral edges; coloration in longitudinal bands .... Salvadora.—p. 180.

e².—Pupil vertically elliptical.

Rostral without free edges; coloration in blotches.

Hypsiglena.—p. 178.

b².—Anal plate single.

j.—Urosteges in one series (at least anteriorly).

Snout protruding; coloration in cross-bands.

Rhinocheilus.—p. 174.

j².—Urosteges in two series.

k.—Scales in twenty-one to twenty-three rows; loreal nearly as high as long; rostral not protruding; coloration in rings, blotches, or lines.. .... Lampropeltis.—p. 166.

k².—Scales in twenty-seven to thirty-one rows; loreal elongate; rostral prominent; coloration in blotches.

Arizona.—p. 192.

a².—Dorsal scales keeled.

Laterals keeled or smooth; anal single; urosteges in two series.

l.—Prefrontals normally four (often two); scales in twenty-seven to thirty-five rows, several of the lower usually smooth; no longitudinal lines................................ Pituophis.—p. 195.

l²—Prefrontals two; scales in seventeen to twenty-three rows; not more than three smooth; usually with longitudinal lines.

Thamnophis.—p. 199.

Genus 24. CHILOMENISCUS.

Chilomeniscus, COPE, Proc. Ac. Nat. Sci. Phila., 1860, p. 339 (type **stramineus**).

The body is stout and cylindrical, with short tail, and without constriction at neck. The snout protrudes far beyond the lower jaw and is rounded and greatly depressed. The internasal is merged in the anterior nasal which, therefore, extends onto the top of the snout. There is a small posterior nasal but no loreal. The scales are in thirteen rows, smooth and with apical pits. The anal plate is divided, and the urosteges are in two series. The eye is small, with round pupil.

47. — Chilomeniscus ephippicus Cope. BURROWING SNAKE.

Chilomeniscus ephippicus, COPE, Proc. Ac. Nat. Sci. Phila., 1867, p. 85 (type locality **Owen's Valley, California**); COUES, Surv. W. 100th Mer., V, 1875, p. 625, pl. XVIII, figs. 3, 3a.

*Description.**—" Scales broad, in thirteen rows; tail about one-seventh total length. Rostral plate large, entirely separating internasals [anterior nasals], not encroaching on prefrontals; [posterior] nasal plate separating prefrontals and labials, in contact with preocular. Postoculars two, upper only in contact with occipital [parietal]. Superciliaries [supraoculars] very narrow, occipitals [parietals] broad as long. Temporals $\frac{1}{1}$ [1+1] large. Labials above, seven, third and fourth in orbit, these with second, narrow erect; first longitudinal; fifth and sixth smaller than the others, seventh suddenly larger. Inferior labials eight, first pair in contact before pregenials; postgenials very small. Gastrosteges 113, separated from geneials by four rows gulars; anal 1–1; urosteges 28–28.

" Above reddish or yellowish, with twenty-one black cross-bars to vent, which are broader than interspaces, and do not quite reach gastrosteges; five nearly complete rings on tail. Belly white. From occipitals [parietals] to anterior part frontal with the labials opposite this part (except their lower edges) black.

" Total length five and one-half inches."

Distribution.—The only Californian locality at which this snake has been taken is Owen's Valley, Inyo County. It has been found in Arizona.

Genus 25. CHIONACTIS.

Chionactis, COPE, Proc. Ac. Nat. Sci. Phil., 1860, p. 241 (type occipitale).

The body is small but not very slender, with short, tapering tail, and little if any constriction at neck. The snout is long, rounded, and much depressed. The head-plates are normal except in the union of the anterior and posterior nasals. One preocular, two postoculars, and a loreal are present. Temporals are normally 1–2. The scales are smooth, in fifteen rows. The anal plate is divided and the urosteges are in two series. The eye is rather small, with round pupil.

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* Original description by Cope.

48.—**Chionactis occipitalis** (Hallowell). DESERT SNAKE.

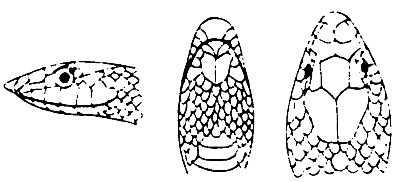
Rhinostoma occipitale, HALLOW., Proc. Ac. Nat. Sci. Phil., VII, 1854, p. 95 (type locality **Mojave Desert**).

Lamprosoma occipitale, HALLOW., l. c., VIII, 1856, p. 310; HALLOW., U. S. Pac. R. R. Surv., X, 1859, pt. IV, p. 15, pl. IV, figs. 2a–2c; KENN., U. S. Mex. Bound. Surv., III, Rept., 1859, p. 21, pl. XXI, fig. 1; BOCOURT, Miss. Sci. au Mex., Rept., 9e Livr., 1883, p. 558, pl. XXXIV, fig. 6–6e.

Lamprosoma annulatum, BAIRD, U. S. Mex. Bound. Surv., III, Rept., 1859, p. 22, pl. XXI, fig. 1 (type locality **Colorado Desert**).

Chionactis occipitalis, COPE, Proc. Ac. Nat. Sci. Phil., 1866, p. 310; COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 605.

Contia occipitalis, GARMAN, Mem. Mus. Compr. Zool., VIII, 3, 1883, p. 91; BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 266.



Description.—"Head small, of same breadth posteriorly as neck, depressed in front; snout rounded; rostral plate large, excavated below, presenting a triangular shape above and in front where it forms the extremity, of the muzzle; internasals smaller than prefrontals, their inner margins much shorter than their external, which are in contact with the upper margins of the nasal plates; the prefrontals are more or less pentangular in shape, the posterior margin of each in contact with the anterior margin of the antocular, the supraocular, and the half of the frontal plate, its external margin with the upper margin of the frenal; the frontal plate is about as broad as long, narrower posteriorly; supraoculars broader posteriorly; occipitals of moderate size, pentangular; nostril large, deeply excavated, in nearly the center of a large and conspicuous nasal plate, somewhat pyriform; a long and very narrow frenal, lying between the second and third supralabials, and the prefrontal; but one preocular, which is quadrangular, resting on the third supralabial; two postoculars, the upper much larger than the lower; there are seven supralabials, the three anterior smaller considerably than those which follow; the eye in contact inferiorly with the third and fourth; body long and slender, depressed; scales, of which there are fifteen rows, quadrangular, smooth and shining, their posterior margins rounded, the three inferior rows larger than the others; gastrostiga appearing to a slight extent upon the flanks; tail short, with a somewhat blunt extremity." Gastrosteges 147–158. Urosteges 34–44.

"Milk white above, with thirty-four transverse black bands, including one upon the posterior part of the head; six complete rings of black upon the tail, and one incomplete just behind the anus; jaws, chin, throat and abdomen white; interspaces between rings upon under part of tail white."

Length to anus	229
Length of tail	56

Distribution.—Mojave and Colorado Deserts.

Genus 26. CONTIA.

Contia, B. & G., Cat. N. A. Rept., I, Serp., 1853, p. 110 (type **mitis**); *Lodia*, B. & G., l. c., p. 116 (type **tenuis**); ? *Sonora*, B. & G., l. c., p. 117 (type **semiannulata**); "*Eirenis*, Jan, Elenco Sist. d. Ofidi, 1863, p. 48."

The body is rather stout for so small a snake, with short, tapering tail, and slight constriction at neck. The head is flat-topped, with broad, rounded snout. Its plates are normal, except that the anterior and posterior nasals usually unite above, or both above and below, the nostril. Usually one preocular and two postoculars are present. Temporals are 1–2. There is one loreal. The scales are smooth, in fifteen or seventeen rows, each with one apical pit. The anal plate is divided, and the urosteges are in two series. The eye is small, with round pupil.

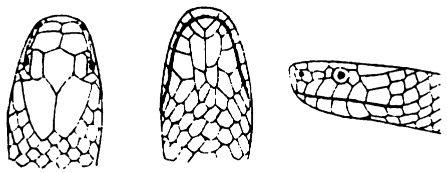
49.—**Contia mitis** Baird & Girard. Sharp-tailed Snake.

Contia mitis, B. & G., Cat. N. A. Rept., I, Serpents, 1853, p. 110 (type locality **San José, Calif.**); Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 87; Boulenger, Cat. Snakes Brit. Mus., II, 1894, p. 267.

? *Lodia tenuis*, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 116 (type locality **Puget Sound, Or.**); Girard, U. S. Explor. Exped., Herp., 1858, p. 122, pl. IX, figs. 8–11; Cope, Proc. U. S. Nat. Mus., XIV, 1891, p. 602.

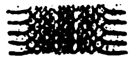
Ablabes purpureocauda, Gunther, Cat. Colub. Snakes, Brit. Mus., 1858, p. 245 (type locality **California**).

Description.—Head wide, with flattened top and broad, rounded snout. Rostral plate large, high, hollowed below, and bounded behind by internasal, nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal broad in front but pointed behind, a long supraocular on each side, and a pair of large parietals. Anterior and posterior nasal plates frequently united above, or both above and below, nostril. Loreal small and nearly square. Normally one preocular, but two sometimes present. Postoculars two,



rarely one. Temporals one followed by two. Seven superior and seven inferior labials, sixth upper and fourth lower largest, third and fourth upper bordering eye, first pair of lower meeting on median line behind small triangular mental. Geneials in two pair, anterior much larger than posterior. Scales on body smooth, in fifteen rows. Anal plate divided. Gastrosteges varying in number from one hundred and fifty-one to one hundred and eighty-six. Urosteges in two series of from twenty-nine to fifty-two. Tail short, conical, ending in a sharply pointed plate.

The color above is grayish or yellowish brown, usually very finely punctulated or reticulated with slate or black, with or without a light yellowish or brownish line along each side. The scales below these lines are sometimes spotted with black. In very young specimens a continuous black line along each side takes the place of these spots, while a similar line runs along the middle of the back. The sides of the head show these lateral black lines more or less distinctly. The tail is colored like the back, except that its upper surface is sometimes suffused with red. The lower surfaces are grayish or yellowish white, transversely barred with black on the anterior half of each gastrostege and (often) urostege.



Length to anus	106	176	238	240	299	330
Length of tail	22	27	57	37	78	83

Distribution.—This harmless little snake is common among the redwoods of Santa Cruz (Big Basin) and San Mateo (Woodside) Counties, California. It has been found also in Santa Clara (San José), Alameda (Haywards, Alameda), Marin, Sonoma (Petaluma), Mendocino (Eel River Bridge), and Shasta Counties. Dr. Yarrow has recorded it from Fresno. I have seen a specimen from Fyffe, El Dorado County. It has not been taken in the southern portion of California, but ranges north across Oregon and Washington to Puget Sound.

Habits.—Unknown.

Genus 27. DIADOPHIS.

Diadophis, B. & G., Cat. N. A. Rept., I, Serp., 1853, p. 112 (type **punctatus**).

The body is slender, with long, tapering tail, and slight constriction at neck. The head is flat-topped, with broad, rounded snout. Its plates are normal. The nasal plates very rarely unite above the nostril. There are two preoculars and two postoculars. Temporals are 1–1. A loreal is present. The scales are smooth, in fifteen or seventeen rows, each with one apical pit. The anal plate is divided, and the urosteges are in two series. The eye is moderately large, with round pupil.

50.—**Diadophis amabilis** Baird & Girard. WESTERN RING-NECK SNAKE.

Diadophis amabilis, BAIRD & GIRARD, Cat. N. A. Rept., Pt. I, Serpents, 1853, p. 113 (type locality **San José, Cal.**); BAIRD, U. S. Pac. R. R. Surv., X, 1859, Pt. III, pl. XXXIII, figs. 83.

Diadophis pulchellus, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 115 (type locality **El Dorado Co., Cal.**); BAIRD, U. S. Pac. R. R. Surv., X, 1859, Pt. III, pl. XXXIII, figs. 85; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 203.

Diadophis punctatus pulchellus, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 27.

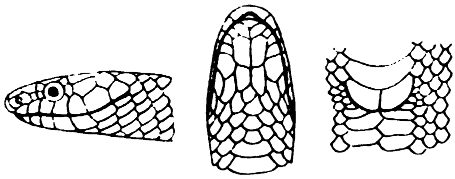
Diadophis punctatus amabilis, YARROW, Bull. U. S. Nat. Mus., 24, 1882, p. 95 (part); TOWNSEND, Proc. U. S. Nat. Mus., 1887, p. 239.

Diadophis amabilis pulchellus, COPE, Proc. U. S. Nat. Mus., XIV, 1891 (1892), p. 616.

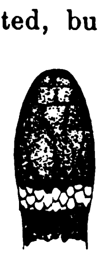
Diadophis amabilis amabilis, COPE, Proc. U. S. Nat. Mus., XIV, 1891 (1892), p. 616.

Coronella amabilis, BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 207 (part).

Description.— Top of head flattened posteriorly, but curving slightly downward to broad, rounded snout. Rostral plate large, broader than high, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a short, broad frontal between two supraoculars, and a pair of long parietals. Anterior and posterior nasals normally distinct, but rarely united above nostril. Loreal small and nearly square. Preoculars and postoculars two each. Temporals one followed by one. Seven (rarely eight) superior and eight (rarely seven) inferior labials, sixth (or seventh) upper and fifth (or fourth) lower largest, third and fourth (rarely fourth and fifth) superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, anterior very slightly, if at all, larger than posterior pair. Scales on body smooth, in fifteen rows. Anal plate divided. Gastrosteges varying in number from one hundred and eighty-two to two hundred and ten. Urosteges in two series of from fifty-three to seventy. Tail tapering, ending in a pointed, conical plate.



The color above is olive, brownish, greenish, bluish, or blackish slate, or gray, minutely reticulated, but without definite markings, except a light collar across the neck just behind the head. This collar may be white, yellow, or unicolor with the belly, and is often edged with black or slate. It covers from one and one-half to three transverse rows of scales. The upper part of the head is usually a darker shade of



the color of the back. The upper labials are partly white or yellow. The lower surfaces, including none, one-half, one, one and one-half, or two rows of scales, are white, yellow, rose,* orange, lake,* or coral red—brightest posteriorly—more or less spotted with black at the posterior edges of the gastrosteges and urosteges and under the head.

Length to anus	137	166	270	333	366	420
Length of tail	32	40	68	66	101	92

Distribution.—The Western Ring-neck or "Red-bellied" Snake lives in all parts of California except the desert area. It is rather inconspicuous, because of its small size, but has been taken in San Diego (San Diego, vic. Carlsbad and Oceanside), San Bernardino (San Bernardino, Ontario), Fresno (Fresno), Mariposa (Mariposa, Yosemite Valley), El Dorado, Santa Cruz (Santa Cruz), Santa Clara (San José, Palo Alto), Alameda (Oakland), Contra Costa (Mount Diablo), Marin, Sonoma (Sonoma, Petaluma, Healdsburg), Napa (Calistoga), Lake (Highland Springs), and Shasta (McCloud River) Counties, California, and in Willamette Valley and at Fort Dalles, Oregon.

Habits.—*Diadophis amabilis* is most often found under boards or logs in moist localities, sometimes even in salt marshes. Its food probably consists chiefly of insects, but one specimen had eaten a half-grown tree-toad (*Hyla regilla*). Nothing is known of its breeding habits.

Genus 28. LAMPROPELTIS.

Lampropeltis, FITZINGER, Syst. Rept., 1843, p. 25 (type **getulus**); *Sphenophis*, FITZ., l. c., p. 25 (type **coccinea**); *Ophibolus*, B. & G., Cat. N. A. Serp., 1853. p. 82 (type **sayi**); *Bellophis*, LOCKINGTON, Proc. Cal. Acad. Sci., VII, 1877, p. 52 (type **zonatus**).

The body is rather thick, with short tail, and little if any constriction at neck. The snout is broad and high. The upper head-plates are normal. The nasal plates are distinct. One (rarely two) preocular and two (rarely one or three) postoculars are present, as is also a small loreal plate. Temporals are normally 2–3, rarely 1–2, 1–3, 2–2, 2–4, or 3–4. The scales are smooth, in twenty-one or twenty-three (or 24) rows, each with two apical pits. The anal plate is undivided, but the urosteges are in two series. The eye is of moderate size, with round pupil.

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*In formalin.

SYNOPSIS OF SPECIES.

a.—Black rings more or less split by red; gastrosteges fewer than 220.
L. zonata.—p. 167.
a^2.—No red; gastrosteges more than 220.
  b.—Color in transverse blotches or rings.....L. boylii.—p. 169.
  b^2.—Color chiefly in longitudinal lines or blotches.
L. californiæ.—p. 172.

51. — **Lampropeltis zonata** (Blainville). CALIFORNIA KING SNAKE.

Coluber (*Zacholus*) *zonatus*, **Blain., Nouv. Ann. du Mus., IV, 1835, p. 293 (type locality California); B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 153.**

Ophibolus pyrrhomelas, **Cope, Bull. U. S. Nat. Mus., I, 1875, p. 37 (part?); Cope, Proc. U. S. Nat. Mus., XIV, 1891, p. 610 (part?).**

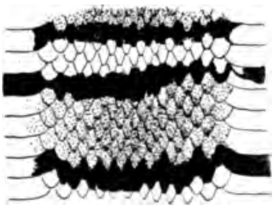
Bellophis zonatus, **Lockington, Proc. Cal. Acad. Sci., VII, 1877, p. 52 (type locality [Santa Barbara,] Calif.).**

Ophibolus getulus multicinctus, **Yarrow, Proc. U. S. Nat. Mus., V, 1882, p. 440 (type locality Fresno, California).**

Coronella multifasciata, **Bocourt, Miss. Sci. au Mex., Rept. 10e Livr., 1886, p. 616, pl. XL, figs. 2-2c (type locality California).**

Coronella zonata, **Boulenger, Cat. Snakes Brit. Mus., II, 1894, p. 202.**

Description.—Top of head slightly flattened posteriorly, curving downward to broad rounded snout. Temporal regions frequently swollen. Rostral plate large, broader than high, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a short, broad, irregularly wedge-shaped frontal between two supraoculars, and a pair of large parietals. Anterior and posterior nasals distinct. A small loreal present, but sometimes united with prefrontal. Two postoculars and one (or rarely two) preocular. Temporals normally two followed by three, sometimes 1–2, 1–3, or 2–4. Seven (rarely six) superior and nine inferior labials, fifth and sixth superior and fifth (or fourth) inferior largest, third and fourth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, anterior larger than posterior. Scales on body smooth, thin, imbricate, in twenty-one or twenty-three rows. Anal plate never divided. Gastrosteges varying in number from one hundred and ninety-nine to two hundred and fifteen. Urosteges in two series of from forty-five to sixty-one. Tail short but slender.



The snout may be black, white, or spotted. The middle third of the head is black. A white band crosses the back of the head, involving the tips of the parietal plates and joining the white of the throat. Behind this white one is a full or half ring of black, followed in turn by another of red. The whole body is similarly marked, being encircled by from twenty-five to forty-three white rings* between which are rings of black more or less divided and replaced by blotches or rings of red or pink. The proportion of black to red varies greatly in different specimens, as does also the intensity of the red. This color is sometimes present anteriorly only, and is usually absent near the tip of the tail. The colors of the back and sides are continued, somewhat irregularly, onto the lower surfaces. The white areas, and more rarely the red ones also, are sometimes tinged with dull yellowish brown. The white rings are little if at all broader on the sides than on the back.

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*Not counting the five to eleven on the tail.

Length to anus	288	486	560	607	695	722
Length of tail	46	71	97	111	118	124

Distribution.—This brilliant snake seems to prefer the moister, cooler portions of the State, such as are occupied by coniferous forests. It has been taken in San Diego (vic. San Diego), San Bernardino (San Bernardino Mountains), Santa Barbara (Santa Barbara), Tulare (Heaven's Gate, near Little Kern Lake), Fresno, Tuolumne (Hodgdon's), Mariposa (Yosemite Valley), El Dorado (Riverton), Santa Cruz (Soquel, Santa Cruz, Glenwood), and Santa Clara (Mt. Hamilton) Counties, California.

Habits.—Very little is known of the habits of this snake. Old hunters say that it destroys many rattlers and other snakes. One of my specimens had eaten two Blue-bellied Lizards (*Sceloporus occidentalis*).

Many names are applied to this species, among which are King Snake, Red Milk Snake, Coral or Corral Snake, Ring Snake, Harlequin Snake, etc. It is popularly supposed to be very poisonous, but, like all Californian reptiles excepting the rattlesnakes, is entirely harmless.

52.—**Lampropeltis boylii** Baird & Girard. Boyle's Milk Snake.

Ophibolus Boylii, B. & G., Cat. N. A. Rept., Pt. I, Serp. 1853, p. 82 (type locality El Dorado Co., Cal.).

Coronella balteata, Hallow., Proc. Ac. Nat. Sci. Phila., VI, 1853, p. 236; *Id.*, Rep. Pac. R. R. Surv., X, pt. 4, 1857, pp. 14, 24, pl. V (type locality "El Paso Creek and Benicia; also intermediate places," California).

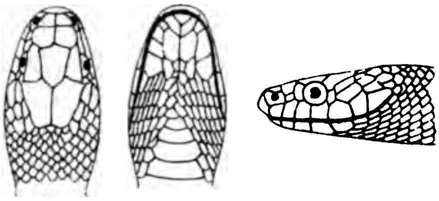
Lampropeltis boylii, Cope, Proc. Ac. Nat. Sci. Phila., 1860, p. 255; Stejneger, N. A. Fauna, No. 7, 1893, p. 204.

"*Coronella getulus*, var. *pseudogetulus*, JAN, Icon. Gen. Ofid., I, Livr. 12, pl. VI, Fig. 2."

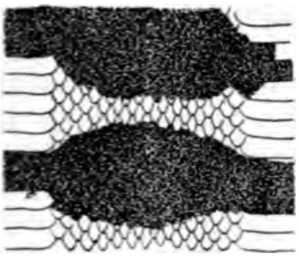
Ophibolus getulus boylii, COPE, Proc. U. S. Nat. Mus., XIV. 1891, p. 613.

Coronella getula, BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 197 (part).

Description.—A larger and stouter snake than *L. zonata*. Top of head slightly flattened posteriorly, curving downward to broad rounded snout. Temporal regions rarely if ever swollen. Rostral plate large, little broader than high, hollowed below and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a short, broad, irregularly wedge-shaped frontal, supraocular of each side, and a pair of large parietals. Anterior and posterior nasals distinct. A small loreal present, but sometimes united with posterior nasal. One preocular and two (rarely one) postoculars. Temporals normally two followed by three, but may be 2-2, 2-4, or 3-4. Seven superior and eight to ten inferior labials, fifth and sixth superior and fifth or fourth inferior largest, third and fourth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, anterior much larger than posterior. Scales smooth, thin, imbricate, in twenty-three rows. Anal plate undivided. Gastrosteges varying in number from two hundred and twenty-one to two hundred and fifty-five. Urosteges in two series of from forty-six to sixty, a few of the first sometimes undivided.



The snout and sides of the head are yellow or white, more or less spotted or blotched with dark brown along the edges of the plates. The nape and the top of the head behind the prefrontal plates are dark brown, with a varying number of white or yellow spots, one of which is very constantly present just behind the parietal plates. The body and tail are marked with great blotches or rings of brown, separated by narrower rings of yellow or white. These white rings are much broader on the sides than near the middle of the back, and vary in number from twenty-four to thirty-five on the body and five to eight on the tail. The markings of the sides are continued onto the lower surfaces.



Length to anus	317	383	586	733	921	954
Length of tail	44	55	93	129	118	135

Distribution.—Boyle's Milk Snake is common in almost all parts of California, where it has been taken in San Diego (San Diego, Santa Margarita), Riverside (San Jacinto, Riverside), Los Angeles (Pasadena), Kern (Ft. Tejon, Kern Valley), Tulare (East Fork Kaweah River, Three Rivers), Fresno (Fresno), El Dorado (Alt. 2000 ft.), Placer (Applegate), Santa Barbara (Santa Barbara), Santa Clara (Los Gatos, Palo Alto), Alameda (Oakland), Solano (Benicia), San Francisco, Marin (Mt. Tamalpais, Camp Taylor), Sonoma (Healdsburg), Mendocino (Irishes), and Shasta (Redding, Ft. Reading, McCloud River) Counties.

It has been recorded from St. Thomas and Overton, Muddy Valley, Nevada.

Habits.—The black and white king snake is most abundant where the country is covered with chaparral and where small streams are numerous. It is usually very gentle, but sometimes fights its captor most fiercely, rarely, however, being able to draw blood with its small teeth. I have twice found it swallowing the contents of quail's nests, and once observed one crawling along the ground and looking up into the bushes for nests of small birds. Several times while I watched its quick eyes detected nests three or four feet above it, but although the snake immediately climbed up to these, it did not obtain a meal, for the nests which it examined had been abandoned by their builders or robbed by some earlier comer.

While I was watching a man spade up a small plot of ground, he killed two gophers *(Thomomys)* and threw them a few feet away. A few minutes later a snake of this species appeared, went directly to the spot where the gophers lay side by side, and swallowed first the adult and then the half grown one. It took no notice of our presence, and after completing its hearty meal disappeared in the direction whence it had come.

53.—**Lampropeltis californiæ** (Blainville). CALIFORNIA MILK SNAKE.

Coluber (Ophis) Californiæ, BLAINV., Nouv. Ann. du Mus., IV, 1835, p. 292, pl. XXVII, figs. 1-1b (type locality **California**); B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 153.

Coronella californiæ, DUM. & BIBR., Erp. Gen., VII, 1854, p. 623.

Ophibolus californiæ, COPE, Bull. U. S. Nat. Mus., No. 1, 1875, p. 37.

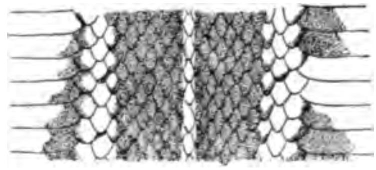
Ophibolus getulus eiseni, YARROW, Proc. U. S. Nat. Mus., V, 1882, p. 439 (type locality **Fresno, California**).

Ophibolus getulus californiæ, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 614.

Coronella getula, BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 197 (part).

Description.—Similar to *L. boylii* in everything but color. Top of head is slightly flattened posteriorly, curving downward to broad rounded snout. Temporal regions rarely if ever swollen. Rostral plate large, little broader than high, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a short, broad, irregularly wedge-shaped frontal, supraocular of each side, and a pair of large parietals. Anterior and posterior nasals distinct. A small loreal. One preocular and two (rarely one or three) postoculars. Temporals normally two followed by three. Seven superior and nine or ten inferior labials, fifth and sixth superior and fifth inferior largest, third and fourth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, anterior much larger than posterior. Scales smooth, thin, imbricate, in twenty-three (or twenty-four) rows. Anal plate undivided. Gastrosteges varying in number from two hundred and twenty-six to two hundred and thirty-six. Urosteges in two series of from fifty to fifty-eight.

This is a very peculiar snake, which may prove to be a mere variation of *Lampropeltis boylii*, from which it does not differ in size, form, or scale characters. There is an immense amount of variation in the color pattern; indeed this is rarely alike in any two specimens. The head is not colored differently from that of *L. boylii*, except that there often is more yellow near the posterior edges of the parietal plates. Along the sides of the body are more or less broken longitudinal lines or bands of white or yellow. Above these the coloration is dark brown to the median line, along which is a single, definite, narrow line, or a series



of small spots or blotches, or both. The tail is dark brown, spotted above with white or yellow. The gastrosteges are yellow or white, unicolor or blotched with brown as in *L. boylii.*

Length to anus	277	342
Length of tail	44	49

Distribution.—The California Milk Snake has been found in San Diego, Riverside, and Fresno Counties.

Habits.—Unknown, but probably like those of *L. boylii.*

Genus 29. RHINOCHEILUS.

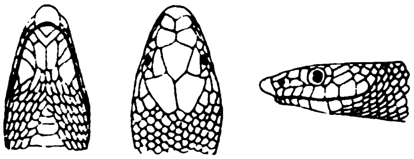
Rhinocheilus, B. & G., Cat. N. A. Rept., I, Serp., 1853, p. 120 (type **lecontei**).

The body is rather slender, with short, tapering tail. The head is slightly distinct from the neck, and ends in a narrow snout which projects far beyond the lower jaw. The head-plates are normal. The nasal plates rarely unite above the nostril. One (or two) preoculars and two (or three) postoculars are present, as is also a small loreal. Temporals are normally two followed by three. The scales are smooth, in seventeen to twenty-five rows, with apical pits. The anal plate is divided. Urosteges are in one series, except usually toward the end of the tail. The eye is of moderate size, with round pupil.

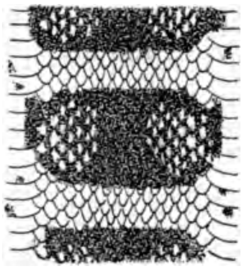
54.—**Rhinocheilus lecontei** Baird & Girard. LONG-NOSED SNAKE.

Rhinocheilus Lecontei, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 120 (type locality **San Diego, California**); BAIRD, U. S. Pac. R. R. Surv., X, 1859, Pt. III, pl. XXIII, figs. 90; BAIRD, U. S. Mex. Bound. Surv., Rept., 1859, pl. XX; BOCOURT, Miss. Sci. au Mex., 1886, p. 602, pl. XL, figs. 7-7d; COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 606; BOULENGER, Cat. Snakes, Brit. Mus., II, 1894, p. 212.

Description.—Head round and snout projecting and pointed. Temporal regions not swollen. Rostral plate large, prominent, recurved on top of snout, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a broad frontal, supraocular of each side, and a pair of rather short, rounded parietals. Anterior and posterior nasals usually distinct, but sometimes united above nostril. Loreal small, elongate, sometimes entering orbit. One or two pre- and two or three postoculars. Temporals normally two followed by three, rarely 2-2, 2-3, or 2-4. Eight (rarely nine) superior and nine (or ten) inferior labials, seventh or eighth superior and fifth or sixth inferior largest, fourth and fifth (or fifth and sixth) superior reaching eye, first pair of inferior meeting on median line. One or two pair of geneials, posterior very narrow when present. Scales on body smooth, thin, in twenty-three or twenty-five rows. Anal plate not divided. Gastrosteges varying in number from one hundred and ninety-one to two hundred and six. Urosteges in one series, or more often in one series anteriorly and two posteriorly, of from forty to fifty-five.



The snout is yellowish more or less marked with black. Back of this the head is black or brown, often spotted with yellow or white. Across the back is a series of large black or brown blotches; twenty to twenty-eight on the body and six to eight on the tail. These blotches may be rounded, pointed, or truncate on the sides, and are from one and one-half to three times as long as the intervals which separate them.



These intervals are brick red, orange, yellow, or white, and usually are continuous with the white or yellow of the lower surfaces. The lateral scales which fall within the dark blotches often have light centers, while those in the light intervals are similarly spotted with black or brown. Small black or brown blotches are sometimes present on the sides midway between the larger ones. The lower surfaces are yellow or white, unicolor or marbled with black or brown.

Length to anus	**275**	**310**	**490**	**496**	**520**	**800**
Length of tail	**43**	**51**	**70**	**73**	**83**	**140**

Distribution.—It is probable that this snake occurs throughout southern California. It has been taken at San Diego, San Diego County, and White River, Tulare County. It ranges east across Arizona.

Habits.—Unknown.

Genus 30. TANTILLA.

Tantilla, B. & G., Cat. N. A. Rept., I, Serp., 1853, p. 131 (type **coronata**); *Homalocranion*, Duméril, Mém. Ac. Sci. Paris, XXIII, 1853, p. 490.

The body is very slender, with tail of moderate length and no constriction at neck. The snout protrudes a little beyond the lower jaw. The head is very low, and very flat above. Its plates are normal, except that there is no loreal. One preocular and one or two postoculars are present. The scales are smooth, arranged in fifteen (or thirteen) rows. The anal plate is divided, and the urosteges are in two series. The eye is small, with round pupil

55. Tantilla eiseni Stejneger. CALIFORNIA TANTILLA.

Tantilla nigriceps, YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 85 (part).

Tantilla eiseni, STEJNEGER, Proc. U. S. Nat. Mus., XVIII, 1896, p. 117 (type locality Fresno, California).

*Description.**—"Head very flat above, rather broad across the anterior temporals; eyes small; rostral wider than high, the portion visible from above longer than the internasal suture; internasals short; prefrontals nearly twice as large as internasals, their lower border wedged in between posterior nasal and preocular, but not in contact with supralabials; frontal rather long, six-sided, angular in front and behind, the lateral borders nearly parallel; supraoculars rather small, half as wide as frontal; parietals long and narrow, nearly as long as their distance from tip of snout; nasals long, the posterior in contact with preocular, which is but slightly shorter; no loreal; one preocular; two postoculars; temporals long, 1+1; supralabials seven, last one largest, third and fourth entering eye; sublabials [infralabials] seven, four in contact with first pair of chin shields; first pair of sublabials not in contact behind mental; fifteen rows of smooth scales; four rows of scales between posterior chin shields and ventrals; ventrals 176 [167–181]; anal divided; subcaudals 62+1 [58–65].

"Color (in alcohol) uniform pale flesh color, slightly darker grayish brown above; top of head, lores, temples, and nape for a distance of three scale-lengths back of the parietals, dark grayish-brown; behind this a narrow white [transverse] band, one scale-length wide, bordered behind by a few dark-brown dots.

"Total length, 365; tail, 82 mm."

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*Original description of Stejneger.

Distribution.—Seven specimens of this little snake were collected by Dr. Gustav Eisen near Fresno, Fresno County, California, in 1879. The species has not been found since.

Genus 31. HYPSIGLENA.

Hypsiglena, COPE, Proc. Ac. Nat. Sci. Phila., 1860, p. 246 (type **ochrorhynchus**); *Pseudodipsas*, PETERS, Mon. Berl. Ac., 1860, p. 521; *Comastes*, JAN, Elenco Sist. Ofid., 1863, p. 102.

The body is small, with moderate, slender tail. The head is distinct from the neck by reason of the swollen temples, which in old specimens are greatly enlarged. The snout is rounded and rather prominent. The head plates are normal. The nasals rarely unite above the nostril. Two (or three) preoculars and two postoculars are present, as is also a loreal. Temporals are normally one followed by two. The scales are smooth, in nineteen or twenty-one rows, with apical pits. The anal plate is divided. Urosteges are in two rows. The eye is of moderate size or small, with vertically elliptic pupil.

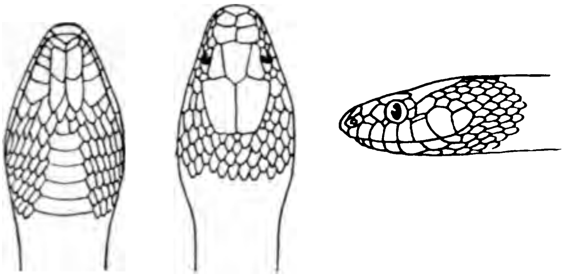
56.—**Hypsiglena ochrorhynchus** Cope. SPOTTED NIGHT SNAKE.

Hypsiglena ochrorhynchus, COPE, Proc. Ac. Nat. Sci. Phila., 1860, p. 246 (type locality **Cape San Lucas, Lower California, Mex.**); COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 32; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 204; BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 209.

Hypsiglena chlorophæa, COPE, Proc. Ac. Nat. Sci. Phila., 1860, p. 247 (type locality **Fort Buchanan, Ariz.**); STEJNEGER, N. A. Fauna, No. 7, 1893, p. 205.

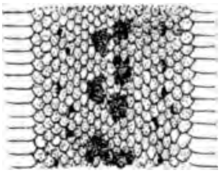
Hypsiglena texana, STEJNEGER, N. A. Fauna, No. 7, 1894, p. 205 (type locality "**between Laredo and Camargo, Tex.**").

Description.—Head flat-topped or slightly rounded, and snout projecting. Temporal regions usually swollen. Rostral plate large, prominent, recurved on top of snout, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of rather short, rounded parietals.



Anterior and posterior nasals usually distinct, but sometimes united above nostril. Loreal small, but often elongate. Two (or one or three) pre- and two postoculars. Temporals normally one followed by two, rarely 2–2. Eight (rarely seven) superior and ten (or nine) inferior labials, sixth or seventh superior and fifth or sixth inferior largest, fourth and fifth or fifth and sixth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, posterior equal to or a little larger or smaller than anterior. Scales on body smooth, thin, in twenty-one rows. Anal plate divided. Gastrosteges varying in number from one hundred and sixty-seven to one hundred and eighty-seven. Urosteges in two series of from forty to fifty-five.

The ground color above is yellowish white, so thickly sprinkled with minute brown or black dots as to present an ashy or olivaceous appearance. Along the middle of the back is a single or double series of more or less alternate and confluent blotches of brown or black. On the sides are two or three or four alternating series of small brown or black spots. There are two or three



elongate dark blotches on the nape, each lateral one being produced forward as a narrow band across the side of the face. These nuchal blotches often unite to form a dark transverse band or collar. The top of the head, the labials, and the geneials are spotted with brown. The gastrosteges are yellowish or white, immaculate. The urosteges are sometimes speckled with gray or brown.

Length to anus	137	282	284	318	325	447
Length of tail	21	60	56	47	60	76

Distribution.—This little snake has been taken in California at San Diego and in the Cuyamaca Mts., San Diego County, at San Jacinto and Strawberry Valley (5,000 feet), Riverside County, at Hesperia, San Bernardino County, and in Shepherd Cañon, Argus Range, Inyo County.

Habits.—Unknown. Probably nocturnal.

Genus 32. SALVADORA.

Salvadora B. & G. Cat. N. A. Rept., I, Serp., 1853, p. 104 (type **grahamiæ**); *Phimothyra*, Cope, Proc. Ac. Nat. Sci. Phila., 1860, p. 566 (type **grahamiæ**).

The body is very long and slender, with long whiplike tail. The head is distinct from the neck, large, long, flat-topped, with truncate snout. Its plates are normal, except the rostral which is very large and has free lateral edges. The nasal plates are distinct. Two preoculars, two postoculars, and a loreal are present. Temporals are 1-2, 2-2, 2-3, or 3-3. The scales are smooth, in seventeen rows, with two apical pits. The anal plate is divided. Urosteges are in two series. The eye is large, with round pupil.

57.—**Salvadora grahamiæ** Baird & Girard. Patched-nosed Snake.

Salvadora grahamiæ, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 104 (type locality "**Sonora, Mex.**"); Baird, U. S. Mex. Bound. Surv., II, 1859, p. 21, pl. V, fig. 2; Bocourt, Miss. Sci. au Mex. Rept., 11e Livr., 1888, p. 661, pl. XLIII, figs. 2-2e; Cope, Proc. U. S. Nat. Mus. XIV, 1891 (1892), p. 619; Van Denburgh, Proc. Cal. Acad. Sci. (2), V, Pt. 1, 1895, p. 146.

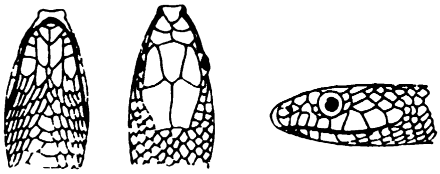
Phimothyra grahamiæ, Cope, Proc. Ac. Nat. Sci. Phila., 1861, p. 300; Cope, l. c., 1883, p. 14.

Phimothyra hexalepis, Cope, Proc. Ac. Nat. Sci. Phila., 1866, p. 304 (type locality **Fort Whipple, Ariz.**).

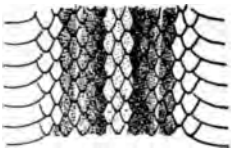
Zamenis grahami, Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 393 (part).

Salvadora grahamiæ hexalepis, Stejneger, N. A. Fauna, No. 7, p. 205.

Description.—Head flat-topped or slightly rounded, and snout projecting and very blunt. Temporal regions not swollen. Rostral plate very large, prominent, recurved on top of snout, with free lateral edges, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of rather short, rounded parietals. Anterior and posterior nasals distinct. Loreal small, but sometimes divided. Two or one pre- and two or three postoculars. Temporals normally two followed by three, rarely 1-2, 2-2, or 3-3. Eight or nine superior and about ten inferior labials, sixth or seventh or seventh and eighth superior and fifth or sixth inferior largest, fourth and fifth or fifth and sixth superior, or small detached portions of them, reaching eye, first pair of inferior meeting on median line. Two pair of geneials,



posterior equal to or smaller than anterior. Scales on body smooth, thin, in seventeen rows. Anal plate divided. Gastrosteges varying in number from one hundred and seventy-four to two hundred and six. Urosteges in two series of from seventy-four to one hundred and eight.



The upper surface of the head is grayish or yellowish brown, without dark or light markings. The ground color of the body is drab, yellow, light brown, or plumbeous, with one or two narrow black, slate, brown, or olive longitudinal bands. These bands fade out on the tail, and may extend on to the sides of the head. Sometimes they widen and merge; in other specimens the upper band is partially broken up into spots; while in one the bands are "represented by blackish shades at the bases of the scales." The upper lip and all the lower surfaces are yellow or yellowish white, the tail and posterior part of the body sometimes with an orange or reddish cast.

Length to anus................	235	258	340	652	695	850
Length of tail................	63	60	98	215	189	290

Distribution.—In California, the Patched-nosed Snake probably ranges over most of the desert area. It has been found at Valle de la Viejas, San Diego County, San Jacinto, Riverside County, at Lytle Creek and near San Bernardino, San Bernardino County, and in Inyo County at the Amargosa Borax Works and in the Argus Range, California. It has been collected in Nevada at St. Thomas and the Virgin River near Bunkerville.

Genus 33. BASCANION.

Bascanion, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 93 (type **constrictor**); *Masticophis*, B. & G., l. c., p. 98 (type **ornatus**).

The body is very long and slender, with long whip-like tail. The head is distinct from the neck, large, long, with flattened top and rounded snout. Its plates are normal. The nasal plates are not united. There are two (rarely one) preoculars and two postoculars. Temporals are normally 2–2. A loreal is present. The scales are smooth, in fifteen, seventeen, or nineteen rows, usually with two (0–3) apical pits. The anal plate is divided.* Urosteges are in two series. The eye is very large, with round pupil.

Four species are known to be Californian. Young of the first two are blotched, of the others, striped.

SYNOPSIS OF SPECIES.

a.—Scales in seventeen rows.
  b.—No distinct longitudinal light lines.
    c.—Urosteges fewer than 100; gastrosteges fewer than 185.
      B. constrictor vetustum.—p. 183.
    c^2.—Urosteges more than 100; gastrosteges more than 190.
      B. flagellum frenatum.—p. 186.
  b^2.—A light line along third and fourth rows of scales.
      B. laterale.—p. 188.
a^2.—Scales in fifteen rows.......... **B. tæniatum.**—p. 190.

58.—Bascanion constrictor vetustum Baird & Girard.

WESTERN YELLOW-BELLIED RACER.

Bascanion vetustus, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 97 (type locality **San José, Calif.**); GIRARD, U. S. Explor. Exped., Herp., 1858, p. 127, pl. VIII, figs. 12–19.

Bascanium constrictor flaviventris, YARROW & HENSHAW, Surv. W. 100th Mer., App. NN., 1878, p. 213; YARROW, Bull. U. S. Nat. Mus., No. 24, 1882, p. 110 (part).

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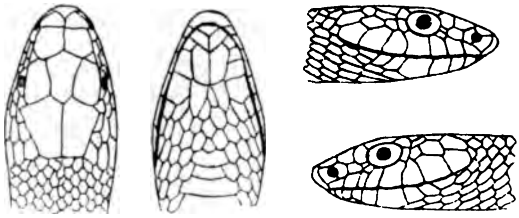
* This plate has been found undivided in *B. flagellum* and its westernmost subspecies *B. f. frenatum*.

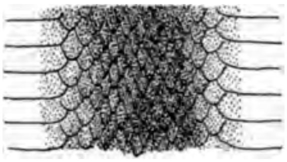
Bascanium constrictor vetustum, TOWNSEND, Proc. U. S. Nat. Mus., X, 1887, p. 240.

Bascanium constrictor, COPE, Proc. U. S. Nat. Mus. XIV, 1891 (1892), p. 624 (part).

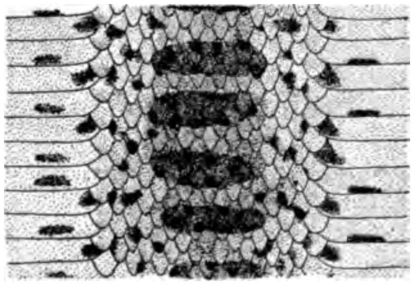
Zamenis constrictor, BOULENGER, Cat. Snakes Brit. Mus., I, 1893, p. 387 (part).

Description.—Head rather long, with flattened top and rounded snout. Rostral plate large, about as high as wide, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, supraocular and part of upper preocular of each side, long frontal, and a pair of large parietals. Anterior and posterior nasals distinct. Loreal well developed. Preoculars normally two, but sometimes united. Postoculars two, upper a little larger than lower. Temporals normally two followed by two, but may be 2–3, 1–2, or 1–1. Seven or eight superior and eight or nine inferior labials, next to last of upper and fifth (or fourth) of lower largest, third and fourth or fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, equal or either pair a little larger. Scales on body smooth, in seventeen rows. Anal plate divided. Gastrosteges varying in number from one hundred and sixty-three to one hundred and seventy-nine. Urosteges in two series of from seventy-nine to ninety-eight.





The color above in adults is green, olive, or yellowish or reddish brown, changing to green (or blue) on the lower rows of scales and the tips of the gastrosteges. There are no dark or light markings but the skin between the scales is often black. The head and tail are unicolor with the body. The lower surfaces are yellow or, rarely, white, unspotted.



Young are colored like adults on the tail and posterior part of the back, but anteriorly are spotted, blotched, or cross-barred with brown of a shade darker than the ground-color. These dark markings spread and blend until the adult coloration is assumed. Dark spots are present also on the tips of the gastrosteges and sides of the head.

Length to anus	203	314	526	626	636	647
Length of tail	64	103	196	217	192	209

Distribution.—The Western Yellow-bellied or "Blue" Racer ranges over the whole length of California, but, I believe, has never been taken in the desert regions of the southeast. It has been collected in San Diego (Agua Caliente 3,400 feet), San Bernardino, Kern (Fort Tejon, Kernville), Monterey (Monterey), Santa Cruz (Glenwood), Santa Clara (Los Gatos, San José, Palo Alto), San Mateo (Pescadero), San Francisco, Alameda (Berkeley), Contra Costa (Crockett), Marin

(Mill Valley, Camp Taylor), Sonoma (Healdsburg), Mariposa (Yosemite Valley), El Dorado (5,000 feet), Placer (Red Point), Lassen (Honey Lake), and Shasta (McCloud River) Counties, California. It crosses Oregon (Klamath Lake, Summer Lake, Warner's Valley, Willamette Valley, Dalles) to Washington (Ft. Steilacoom, Puget Sound) and Idaho (Atlanta, mouth of Bruneau River, Big Butte).

Habits.—Like other members of its genus, the Western Yellow-bellied Racer is a skillful climber and often runs through the tops of the bushes at almost as great a speed as when upon the ground. It is frequently found, however, in open country or in fields of growing grain.

59.—**Bascanion flagellum frenatum** Stejneger. WESTERN WHIP SNAKE.

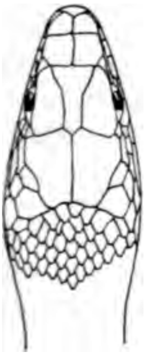
Bascanium flagelliforme testaceum, YARROW, Bull., U. S. Nat. Mus., 24, 1882, p. 112 (part).

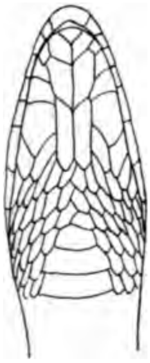
Bascanium testaceum, COPE, Proc. Ac. Nat. Sci. Phila., 1883, pp. 29, 32.

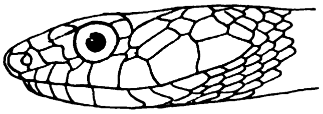
Bascanium flagelliforme, COPE, Proc. U. S. Nat. Mus., XIV, 1891 (1892), p. 625 (part).

Bascanion flagellum frenatum, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 208 (type locality **Mountain Spring, Colorado Desert, San Diego County, Calif.**)

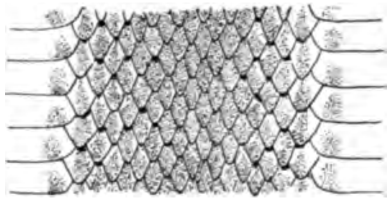
Description.—Head rather long, with flattened top, and narrow, rounded snout. Rostral plate large, high, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, supraocular and part of upper preocular of each side, long frontal, and pair of large parietals. Anterior and posterior nasals distinct. Loreal well developed. Preoculars normally two, but sometimes united. Postoculars two, upper a little larger. Temporals normally two followed by two, but rarely 2–1, 1–2, or 1–1. Eight or nine superior and ten or eleven inferior labials, seventh or eighth upper and fifth lower largest, fourth and fifth or fifth and sixth superior reaching eye, first pair of inferior meeting on median line. Geneials in two pair, posterior pair a little larger. Scales on body smooth, in seventeen rows. Anal plate almost always divided. Gastrosteges varying in number from one hundred and ninety-seven to two hundred and six. Urosteges in two series of from one hundred and four to one hundred and twenty-three. Third, fourth, and fifth urosteges of one specimen not divided.







The general color is whitish, grayish, ochraceous, brownish, or straw yellow, usually lightest at the edges of the scales, often spotted with brown or black at their tips or bases. Across the nape are several (3–7) brownish or blackish bands, often more or less blended. Faint indications of longitudinal lines may sometimes be seen along the sides. The lower surfaces are pale



yellow or white, more or less spotted anteriorly with black, gray, brown, or yellow. These spots usually form one row along each side of the anterior gastrosteges.

Young are more or less distinctly cross-barred above with gray, brown, or black, and show a light line or blotch along the side of the face. The latter mark is often retained by adults.

Length to anus	303	541	723
Length of tail	96	185	242

Distribution.—The Western Whip Snake or "Red Racer" has its true home in the deserts of San Diego, San Bernardino, Kern, and Inyo Counties, but lives also in the southwestern part of the State, and along the eastern side of the San Joaquin Valley. It has been taken in San Diego (Fort Yuma, Mountain Spring Colorado Desert, San Diego, Agua Caliente), Riverside (Palm Springs, San Jacinto, Riverside), Los Angeles (Pasadena, Drum Barracks), San Bernardino (Ontario, Needles), Inyo (Death Valley, Panamint Valley, Deep Spring Valley, Keeler, Owen's Valley), Fresno (Fresno), Mariposa (Yosemite Valley) Counties, California, and crosses southern Nevada (Vegas Valley, Overton).

Habits.—The "Red Racer," like its relatives, is remarkable for the quickness of its movements. It climbs trees and bushes with great agility.

60.—**Bascanion laterale** (Hallowell). CALIFORNIA RACER.

Leptophis lateralis, HALLOW., Proc. Ac. Nat. Sci. Phila., VI, 1853, p. 237 (type locality **California**); HALLOW., Pac. R. R. Surv., X, Rept., 1859, p. 13, pl. IV, fig. 3a-3c.

Bascanium tæniatum laterale, YARROW, Bull. U. S. Nat. Mus., 24, 1882, p. 113 (part).

Bascanium laterale laterale, COPE, Proc. U. S. Nat. Mus., XIV, 1891, (1892), p. 628.

Bascanion laterale, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 209.

Description.—Head long, with flattened top and narrow, rounded snout. Rostral plate large, about as high as broad, hollow below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a larger pair of prefrontals, supraocular and part of upper preocular of each side, long and posteriorly narrow frontal, and a pair of very large parietals. Anterior and posterior nasals distinct. Loreal rather large, rarely with a small plate below it. Preoculars two, upper much larger than lower. Postoculars two (or three), nearly equal. Temporals two followed by two, rarely 1–2 or 1–1. Eight (or seven) superior and ten (or nine) inferior labials, seventh (or sixth) of upper and fifth of lower series largest, fourth and fifth (or third and fourth) of upper reaching eye, first pair of lower meeting on median line. Geneials in two pair, posterior larger than anterior. Scales on body smooth, in seventeen rows. Anal plate divided. Gastrosteges varying in number from one hundred and ninety to one hundred and ninety-seven. Urosteges in two series of from one hundred and twenty-two to one hundred and thirty-three. Tail very long and slender.

The color above, including the tips of the gastrosteges and urosteges, is dark brown, palest on the tail. A single light yellow or white line extends along each side, on the third and fourth rows of scales, to, or a little beyond, the base of the tail. This line is often bordered with black and its scales are sometimes tipped with orange-rufous. The sides of the head are spotted with yellow. All the lower surfaces and the upper labials are yellow, spotted

on the head and anterior gastrosteges with gray, slate, or brown. The anterior gastrosteges are sometimes washed with orange-rufous.

Length to anus	632	725	742	787	804	968
Length of tail	275	311	329	338	396	

Distribution.—The Californian Racer appears to be confined to those parts of California which lie to the west of the Sierra Nevada and Mojave and Colorado Deserts. The northern limit of its range is not known. It has been taken in San Diego (Santa Ysabel, Agua Caliente, Oak Grove), Riverside (San Jacinto, Strawberry Valley, Riverside), Los Angeles (Los Angeles), Santa Barbara (Santa Barbara), Kern (Fort Tejon, Walker Pass), Tulare (Three Rivers), Fresno (Fresno), Monterey (Carmel Valley), Santa Clara (Los Gatos), and Lake (Mt. Saint Helena) Counties.

Habits.—Nothing is known of the habits of this snake, except that, like other members of the genus, it is very active and a skillful climber.

61.—**Bascanion tæniatum** (Hallowell). Striped Racer.

Leptophis tæniata, Hallow., Proc. Ac. Nat. Sci. Phila., 1852, p. 181 (type locality **New Mexico**); Hallow., Sitgreave's Zuni and Colorado Riv., 1853, p. 133, pl. XIII (XII).

Masticophis tæniatus, Baird & Girard, Cat. N. A. Rept., Pt. I, Serp., 1853, p. 103; B. & G., Pac. R. R. Surv., X, Rept., 1859, pl. XXXII, fig. 76.

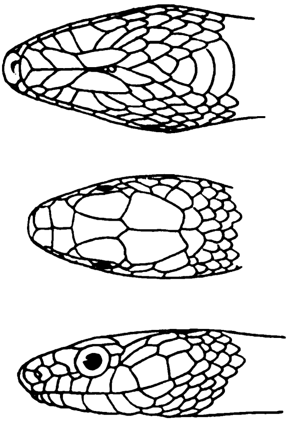
Bascanium tæniatum tæniatum, Yarrow, Bull. U. S. Nat. Mus., 24, 1882, p. 112.

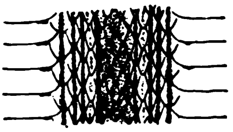
Bascanium tæniatum, Cope, Proc. U. S. Nat. Mus., XIV, 1891 (1892), p. 629.

Bascanion tæniatum, Stejneger, N. A. Fauna, No. 7, 1893, p. 210.

Zamenis tæniatus, Boulenger, Cat. Liz. Brit. Mus., I, 1893, p. 390 (part).

Description.—Head long, with flattened top and rounded snout. Rostral plate large, about as high as broad, hollowed below, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefontals, supraocular and part of upper preocular of each side, long frontal, and a pair of large parietals. Anterior and posterior nasals distinct. Loreal longer than high. Preoculars two, upper much larger than lower. Postoculars two, nearly equal. Temporals two followed by two. Eight superior and nine or ten inferior labials, seventh of upper and fifth of lower largest, fourth and fifth upper reaching eye, first pair of lower meeting on median line. Geneials in two pair, anterior smaller than posterior. Scales on body smooth, in fifteen rows. Anal plate divided. Gastrosteges varying in number from two hundred and four to two hundred and nine. Urosteges in two series of from one hundred and thirty-six to one hundred and fifty-seven.





The color above is grayish or yellowish brown, palest on the tail, the scales of the sides more or less yellow and with narrow dark lines along the middle of each row. These dark lines are sometimes present on the dorsal scales as well as those of the sides and a wider line often runs along the tips of the gastrosteges. The yellow of the lateral scales is variable in intensity, and sometimes—especially in young—forms a distinct line along the third and fourth rows of scales. All of these lines fade out on the tail. The head is spotted with yellow. The lower surfaces are yellow or yellowish white, marked with slate or black anteriorly and along the tips of the gastrosteges, and often more or less tinted posteriorly with delicate rose pink.

Length to anus	803	910
Length of tail	350	366+

Distribution.—The Californian range of this racer seems to be restricted to the dryer eastern portions of the State, leaving the more western parts to *B. laterale.* "It is much more widely distributed [than the Californian racer], as specimens have been taken in Idaho, Utah, Nevada, Arizona, New Mexico, and Mexico, but it does not seem to reach the coast, nor does it appear in the Valley of California, except at two points. These are Walker Basin and Shasta County, northern California, where [Shasta Co.] it probably enters by way of Pitt River Valley."* Localities at which it has been taken in California are Shasta County (Baird, Canoe Creek), Inyo County (Argus Range, Coso Valley and Mountains, Panamint Mountains), and Kern County (Walker Basin); in Nevada, Carson City, and Antelope Springs; in Oregon, Snake River; and in Idaho, between Bliss and the Snake River.

Genus 34. ARIZONA.

Arizona, KENN., U. S. Mex. Bound. Surv., II, 1859, Rept., p. 18 (type **elegans**).

The body is long and slender, with tail of moderate length. The neck is constricted somewhat, so that the head is distinct. The snout is long, rounded, and but little lower than the flat top of the head. The cephalic plates are normal. The nasals rarely unite above the nostril. One (or two) preocular, two (or one) postoculars, and a loreal are present. Temporals are 2-3 or 2-4. The scales are smooth, in twenty-seven to thirty-one rows. The anal plate is single. Urosteges are in two series. The eye is moderately large, with round pupil.

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* Stejneger, N. A. Fauna, No. 7, 1893, p. 210.

62.—Arizona elegans Kennicott. Faded Snake.

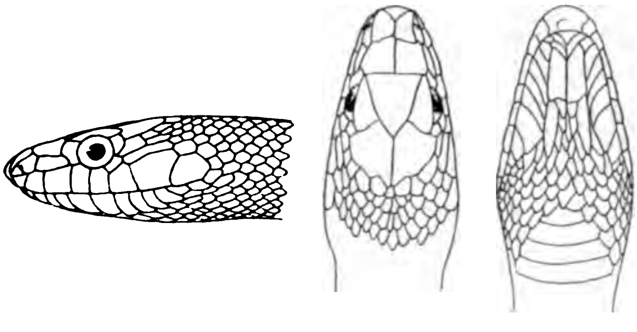
Arizona elegans, **Kenn.**, **U. S. Mex. Bound. Surv., II, 1859, Rept., p. 18, pl. XIII (type locality Rio Grande); Bocourt, Miss. Sci. au Mex., Rept., 11e Livr., 1888, p. 676, pl. XLVI, figs. 3-3b.**

Pityophis elegans, **Cope, Bull. U. S. Nat. Mus., No. 1, 1875, p. 39.**

Rhinechis elegans, **Cope, Proc. Am. Philos. Soc., XXIII, 1886, p. 284; Cope, Proc. U. S. Nat. Mus., XIV, 1891 (1892), p. 638.**

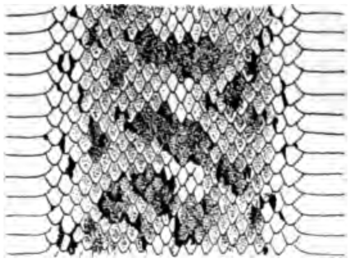
Coluber arizonæ, **Boulenger, Cat. Snakes Brit. Mus., II, 1894, p. 66.**

Description.—Head flat-topped or slightly rounded, with snout projecting and rather narrow. Temporal regions not swollen. Rostral plate very large, prominent, recurved between internasals on top of snout, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of large parietals. Anterior and posterior nasals usually distinct, but sometimes united above nostril. Loreal elongate. One or two preoculars and two or one postoculars. Temporals normally two followed by three, or 2-4, lower scale of first row often



elongate. Eight or seven superior and thirteen to fifteen inferior labials, sixth or seventh superior and seventh or eighth inferior largest, fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior narrower and shorter or but little longer than anterior. Scales on body smooth, thin, in twenty-seven to thirty-one rows. Anal plate not divided. Gastrosteges varying in number from two hundred and ten to two hundred and twenty-seven. Urosteges in two series of from forty-five to fifty-nine.

The ground color is pale brown or yellowish gray, lighter near the middle of the back, along which is a series of dark-edged brown or gray blotches. The sides are marbled with similar but smaller blotches in more or less alternating rows. The tail is similarly colored. In young, a dark streak runs from the eye to the corner of the mouth, and another between the eyes, crossing the posterior edges of the prefrontal plates as in *Pituophis*. These streaks are faded or absent in adults. The lower surfaces are pale yellowish white, without markings.



Length to anus	231	282	730	860	870
Length of tail	33	33	122	160	125

Distribution.—This smooth-scaled relative of the true gopher snakes has been taken in California between Carlsbad and Oceanside and at Warner's Ranch, San Diego County, at San Jacinto, Riverside County, and near Ontario, San Bernardino County. It ranges east to Texas.

Habits.—Unknown. A captive individual ate a Brown-shouldered Lizard (*Uta stansburiana*).

Genus 35. PITUOPHIS.

Pituophis, HOLBROOK, N. A. Herpet. (2), IV, 1842, p. 7 (type **melanoleucus**); *Churchillia*, B. & G., Stansbury's Exped. Gt. Salt Lake, 1852, p. 350 (type **bellona**).

The body is long but rather stout, with tail of moderate length. The neck usually is slightly constricted, so that the head appears little distinct from it. The snout is long, narrowly rounded, and projecting beyond the lower jaw. The head-plates show many variations, but when typical are normal except that there are four prefrontals. The nasals are usually distinct. One or two preoculars, two to four postoculars, and a loreal are present. Temporals are many and very variable. The scales are in twenty-seven to thirty-five rows, the dorsals keeled, some of the lateral rows smooth. The anal plate is single. Urosteges are in two series. The eye is large, with round pupil.

63.—**Pituophis catenifer** (Blainville). WESTERN GOPHER SNAKE.

Coluber catenifer, BLAIN., Nouv. Ann. Mus. Hist. Nat., IV, 1835, p. 290, pl. 26, figs. 2-2b (type locality **California**); BOULENGER, Cat. Snakes Brit. Mus., II, 1894, p. 67.

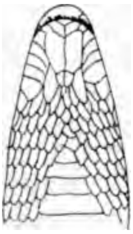
Pituophis catenifer, B. & G., Cat. N. A. Rept,, Pt. I, Serp., 1853, p. 69; GIRARD, U. S. Explor. Exped., Herp., 1858, p. 135, pl. VIII, figs. 1-7; GÜNTHER, Cat. Colub. Snakes Brit. Mus., 1858, p. 87; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 206.

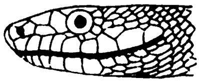
Pituophis Wilkesii, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 71 (type locality "**Puget Sound, Oregon**"); GIRARD, U. S. Explor. Exped., Herp., 1858, p. 137, pl. IX, figs. 1-7.

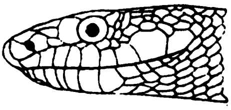
Pituophis annectens, B. & G., Cat. N. A. Rept., p. 72 (type locality **San Diego, Cal.**).

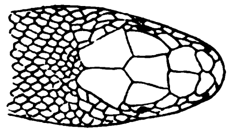
Pityophis Heermannii, HALLOW., Proc. Ac. Nat. Sci. Phila., VI, 1853, p. 236 (type locality **Cosumnes River, Cal.**).

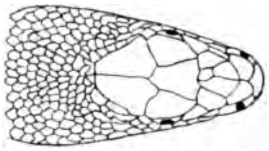
Pityophis catenifer, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 641.

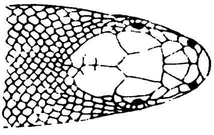




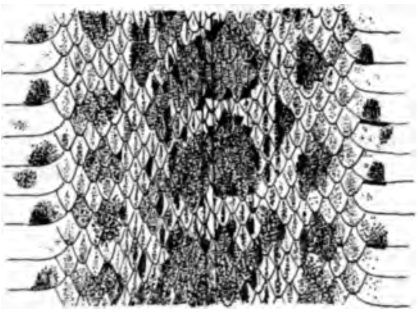








Description.—Head flat-topped or rounded, with snout projecting and rather narrow. Temporal regions not swollen. Rostral plate very large, prominent, not very narrow, but often recurved between internasals on top of snout, and bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, four, two, one, three, five, six, or eight prefrontals, a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals usually distinct, sometimes united. Loreal usually elongate. One or two preoculars and two to four postoculars. Tips of some labials often cut off, forming suboculars or loreals. Temporals four followed by five, very variable. Seven to nine superior and eleven to thirteen inferior labials, next to last superior and sixth or seventh inferior largest in its series, fourth or fifth superior usually reaching eye, first pair of inferior meeting on median line. Two pair of geneials, anterior much larger than posterior. Scales on body in twenty-seven to thirty-five rows, keeled except in a varying number (about 3 to 10) of rows on each side. Anal plate not divided. Gastrosteges varying in number from two hundred and four to two hundred and forty-five. Urosteges in two series of from fifty-six to seventy-two.



The ground color is pale brown or yellowish gray, sometimes obscured by the spreading of the blotches or the presence of black marks along the keels of its scales. Along the middle of the back is a series of from thirty-six to seventy-nine dark brown or black blotches. There are several series of smaller alternating dark blotches or spots on the sides. These spots sometimes tend to unite to form longitudinal lines. Across the top of the head, between the preocular plates, is a line of black or brown. A similar line runs down from the center of the eye and another back and down from the upper postocular plate. The lower surfaces are yellowish white, usually maculated with black or brown.

Length to anus......................	315	660	820	860	1200	1260
Length of tail......................	52	135	165	170	270	210

Distribution.—The Western Gopher Snake occupies the Pacific Coast of the United States, but is replaced in the Great Basin by its subspecies *P. catenifer deserticola*. It ranges north and south at least from Puget Sound to San Diego. The eastern limit of its territory in the north (in Idaho) is not known, but in California is marked by the Sierra Nevada and the western edge of the Mojave and Colorado Deserts. In California, it has been taken in San Diego (San Diego), Riverside (San Jacinto), San Bernardino (Ontario), Los Angeles (Pasadena), Santa Barbara (Santa Barbara), Kern (Fort Tejon), Fresno (Pitman Creek, King's River), Montery (Monterey), Santa Cruz (Soquel, Corralitos, Glenwood), Santa

Clara (Los Gatos, San José, Palo Alto), San Francisco, Alameda (Haywards, Oakland), Marin (Tamalpais), Sonoma (Petaluma), Lake (Kelseyville), Mendocino, Shasta (McCloud River), and Siskiyou (Mt. Shasta) Counties.

Habits.—The Gopher or Bull Snake is the largest as well as one of the most abundant of Californian serpents. Individuals more than six feet long are not rarely found. These are usually very gentle and show little resentment even when roughly handled. The younger snakes, however, sometimes strike very fiercely, but of course harmlessly. This snake shares with many others the curious habit of rapidly vibrating the tip of its tail when excited; an action which sometimes, when the tail happens to strike upon dry leaves or grass, produces a sound not unlike the warning whir of the rattlesnake. Its food, so far as is known, consists of small mammals, of which gophers are said to form a large part.

64.—**Pituophis catenifer deserticola** Stejneger. DESERT GOPHER SNAKE.

Pityophis sayi bellona, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 641 (part).

Pituophis catenifer deserticola, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 206 (type locality **Great Basin and southwestern deserts**).

Description.—I have seen no specimens of this "richly-colored form from the Great Basin and southwestern deserts, which agrees with true *P. catenifer* in having a broad and low rostral. * * * As a general rule this form has a more pronounced carination of the scales and a less number of smooth scales on the sides, but this character cannot be relied upon at all, and whether a specimen shall be referred to either typical *P. catenifer* or to this desert form must be decided upon the totality of the characters, as a reliance upon the carination leads to very erroneous results."

Distribution.—The Desert Gopher Snake occupies the Mojave and Colorado Deserts and those parts of the Great Basin which lie within California, Nevada, and perhaps southern Idaho and eastern Oregon.

Habits.—Unknown, but similar, doubtless, to those of *P. catenifer.*

Genus 36. THAMNOPHIS.

Thamnophis, FITZINGER, Syst. Rept., 1843, p. 26 (type **saurita**); *Eutainia*, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 24 (type **saurita**).

The body is more or less elongate, usually rather slender, with moderately long, tapering tail, and head distinct from neck. The cephalic plates are normal. The nasals never unite. One or two (rarely three) preoculars, two to four postoculars, and a loreal are present. Temporals are normally 1–2, but may be 1–1, 1–3, or 2–3. A loreal is present. The scales are keeled, in seventeen to twenty-three rows. The anal plate is undivided. Urosteges are in two series. The eye is moderate or small, with round pupil.

Although the several species and subspecies may often be distinguished at a glance by one familiar with their several characters, the amount of individual variation is so great that it is quite impossible to make a key which will properly refer all specimens. The following synopsis will, I believe, usually serve its purpose, but should not be trusted too implicitly.

SYNOPSIS OF SPECIES.*

a.—Upper labials seven; posterior geneials much longer than anterior.

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* If my estimate of the status of the various western members of this genus differs rather radically from that of recent authors (the latest American review of this genus admits seventeen species and subspecies from the territory under discussion), I may, perhaps, be pardoned on the ground that I have carefully examined more than three hundred fresh alcoholic specimens besides rather hastily inspecting the material in the National Museum.

b.—Eye large; one preocular; scales in nineteen rows; dorsal line never red.

c.—Lines wide; some red on body..... **T. parietalis.**—p. 200.

c^2.—Lines very narrow; no red on body; belly dusky. **T. p. pickeringii.**—p. 204.

b^2.—Eye small; two preoculars or scales in seventeen rows, or both; dorsal line sometimes red.................. **T. leptocephala.**—p. 205.

a^2.—Upper labials eight.

d.—Scales in nineteen rows (if in 21 rows, some red on body or very distinct lines with few or no spots).

e.—Eye smaller; posterior geneials rarely much longer than anterior; dorsal line yellow or red; head never red; belly sometimes red. **T. elegans.**—p. 207.

e^2.—Eye larger; posterior geneials much longer than anterior; dorsal line blue or yellow; head sometimes red; belly never red. **T. parietalis.**—p. 200.

d^2.—Scales in twenty-one (or twenty-three) rows; no red on body; many spots or no distinct dorsal line.

f.—Eye smaller; posterior geneials shorter or but little longer than anterior; belly marbled with slate; dorsal line present.

g.—One preocular; scales in twenty-one rows. **T. vagrans.**—p. 210.

g^2.—Two preoculars; scales in twenty-one or twenty-three rows. **T. v. biscutata.**—p. 212.

f^2.—Eye larger; posterior geneials much longer than anterior; belly not marbled with dusky; dorsal line often absent. **T. hammondii.**—p. 212.

65.—Thamnophis parietalis (Say). Pacific Garter Snake.

Coluber parietalis, Say, Long's Exped. Rocky Mts., I, 1823, p. 186 (type locality **Camp Missouri near Council Bluff**).

Coluber infernalis, Blainv., Nouv. Ann. du Mus., IV, 1835, p. 291, pl. XXVI, figs. 3-3^a. (type locality **California**).

Eutainia infernalis, B. & G., Cat. N. A. Rept., Pt. 1, Serp., 1853, p. 26; Girard, U. S. Explor. Exped., Herp., 1858, p. 148, pl. XIV, figs. 11-16; Bocourt, Bull., Soc. Zool. Fr., 1892, p. 40 (part).

Eutainia parietalis, B. & G., Cat. N. A. Rept., Pt. 1, Serp., 1853, p. 28.

?*Eutaenia ornata*, B. & G., U. S. Mex. Bound. Surv., III, Rept., 1859, p. 16, pl. IX (type locality between **San Antonio and El Paso, Tex.**).

Eutænia sirtalis tetratænia, COPE, U. S. Explor. Surv. W. 100th Mer., V, 1875, p. 546 (no locality); COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 664 (**Puget Sound, Wash., and Pitt River, Cal.**).

Eutænia pickeringii, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 21.

Tropidonotus sirtalis var. *parietalis*, GARMAN, Mem. Mus. Compar. Zool., VIII, 3, 1883, pp. 25, 139.

Eutænia sirtalis parietalis, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 664.

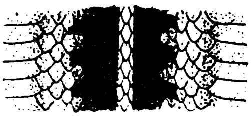
Eutænia sirtalis trilineata, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 665 (part), (**Fort Benton, Mont.**).

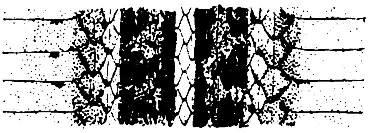
Tropidonotus ordinatus var. *infernalis*, BOULENGER, Cat. Snakes Brit. Mus., I, 1893, p. 207 (part).

Thamnophis parietalis, STEJNEGER, N. A. Fauna, No. 7, 1893, p. 214.

Description.—Head distinct from neck, flat-topped, with narrow, rounded snout, and temporal regions sometimes swollen. Rostral plate large, bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals distinct. One loreal. One preocular and from two to four postoculars. Temporals normally one followed by two, sometimes 1-1, 1-3, or 2-3. Seven, or rarely eight, superior and nine to eleven inferior labials, fifth or sixth superior and fifth, sixth, or seventh inferior largest, third and fourth or fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior longer than anterior. Scales on body in nineteen, or very rarely twenty-one, rows, all keeled except sometimes the first row of each side. Anal plate not divided. Gastrosteges varying in number from one hundred and fifty-one to one hundred and seventy. Urosteges in two series of from seventy-four to ninety-four, a few of the anterior rarely undivided. Eye large.

There are three light lines, one on the middle of the back and one along the second and third rows of scales of each side, but the lateral lines not infrequently blend with the color of the belly. The dorsal line usually is bluish but may be yellow. The belly is bluish or yellowish, or rarely slaty, and may have a black line or series of spots near the tips of the gastrosteges. The head may be brown, olive, or coppery red above, bluish or grayish laterally, yellowish white below. The tail is colored like the back, but less definitely. In some specimens the ground color above is solid black, without a trace of red. In others there are traces of red on the sides, chiefly on the skin between the scales. In several the red is more extensive and forms small irregular blotches on the sides. In a number these blotches are larger and extend up from the lateral line in definite and more or less rectangular figures, between which are similarly shaped prolongations downward of the black ground.* Many show the red blotches spread out and blended above, so that the downward prolongations of the ground color have become detached and form a series of black spots separated, by red, from the narrow band of ground color remaining on each side of the light dorsal line. In others these black spots have become united and form a black line, so that on each side of the light dorsal line we have a line of black, one of red, another of black, and the light lateral line.† In one specimen the black is almost





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* This and the following are the most common forms.

† The *Eutænia sirtalis tetratænia* of Cope.

entirely replaced by red. These color variations are all individual, none geographical.

Length to anus	185	475	565	695	715	870
Length of tail	67	160	190	227	200	210+

Distribution.—The Pacific Garter Snake ranges all over the territory under consideration, excepting the desert areas and the western parts of Washington and Oregon. It is abundant in eastern Washington and Oregon and in Idaho, and has been reported from several localities in Nevada.

It occurs in all parts of California except the Mojave and Colorado Deserts. I have examined specimens from Siskiyou (Mt. Shasta), Placer (Lake Tahoe), Mariposa (Yosemite Valley), Fresno (Fresno), Humboldt, Mendocino (Pieta), Lake (Kelseyville), Sonoma (Healdsburg, Duncan's Mills), Marin (Tomales Bay), Santa Clara (Palo Alto), Santa Cruz (Glenwood), San Bernardino (Ontario) and Riverside (Riverside) Counties.

Habits.—Like its relatives, the Pacific Garter Snake is seldom found far from water. Its food is composed of fish, batrachians, and the smaller mammals. "Along the shores of the larger island in Pyramid Lake vast numbers of *Eutæniæ* are found, comprising this and, in all probability, several other recognized varieties. During the heated part of the day, the mossy tracts in the tepid, shallow water of the little inlets were thronged with them, as they swam in gentle undulations over the smooth surface or idly basked on the heated rocks along the shore. In no other locality have we ever seen them in such numbers. When disturbed, they swam boldly out into open water or sought the bottom and hid themselves under the rocks. Though not in the true sense of the word 'water snakes,' the various *Eutæniæ* are all thus quite aquatic in their habits." *

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* Yarrow & Henshaw, Ann. Rep. Surv. W. 100th Mer., Append. NN, 1878, p. 217.

66.—**Thamnophis parietalis pickeringii** (Baird & Girard).

NORTHWESTERN GARTER SNAKE.

Eutainia Pickeringii, B. & G., Cat. N. A. Rept., Pt. 1, Serp., 1853, p. 27 (type locality **Puget Sound**); GIRARD, U. S. Explor. Exped., Herp., 1858, p. 150, pl. XIII, figs. 14–20.

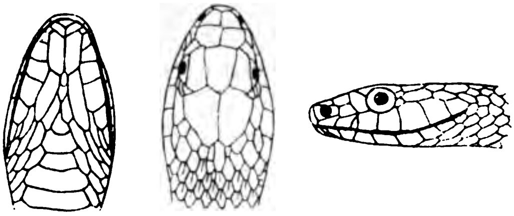
Eutainia concinna, B. & G., Cat. N. A. Rept., Pt. 1, Serp., 1853, p. 146.

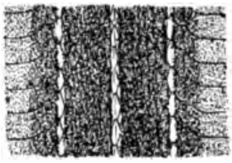
Eutænia sirtalis concinna, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 664.

Eutænia sirtalis pickeringii, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 665.

Eutænia sirtalis trilineata, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 665 (part), ("**Port Townsend, Oregon**").

Description.—This subspecies differs from *T. parietalis* in color only. Some specimens approach the typical form in having red blotches on the sides. The normal coloration is, however, fairly constant. The ground color above is deep blackish brown or black, with three light longitudinal lines. These lines are usually very narrow, but may be as wide as in the typical *T. parietalis*, and may be white, grayish, bluish, greenish, or pale yellow. The median dorsal line may fade out posteriorly, and the lateral lines may be very faint. A narrow black line sometimes runs along the tips of the gastrosteges. The top of the head is blackish, its sides light. The lower surfaces are bluish black, slate, or greenish, lighter anteriorly; the throat being yellowish white.





This form may be readily distinguished from *T. leptocephala*, of the same regions, by its larger eye.

Length to anus	165	410	500	540	650	690
Length of tail	51	125	180	160	190	215

Distribution.—This northern form of the Pacific Garter Snake inhabits British Columbia and the northwestern corner of the United States in the neighborhood of Puget Sound. It is abundant in King County, Washington, and on Vancouver Island, and has been reported from Oregon.

67.—**Thamnophis leptocephala** (Baird & Girard). PUGET GARTER SNAKE.

? *Tropidonotus ordinoides*, B. & G., Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 176 (type locality **Puget Sound**).

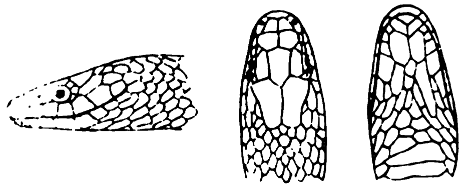
? *Tropidonotus concinnus*, HALLOW., Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 182 (type locality **Oregon Territory**).

Eutainia leptocephala, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 29 (type locality **Puget Sound**); GIRARD, U. S. Explor. Exped., Herp., 1858, p. 151, pl. XIII, figs. 7-13.

?? *Eutainia atrata*, KENN., U. S. Pac. R. R. Surv., XII, Pt. II, 1860, p. 296 (type locality "**California**"?).

Eutainia cooperi, KENN., U. S. Pac. R. R. Surv., XII, Pt. II, 1860, p. 296, pl. XV, fig. 1 (localities **Cathapoot'l and Willopah Valleys**).

Description.—Head distinct from neck, flat-topped, with narrow, rounded snout, and temporal regions sometimes slightly swollen. Rostral large, bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals distinct. One loreal. One or two preoculars and about



three postoculars. Temporals normally one followed by two, sometimes 1–3. Seven, or rarely six or eight, superior and eight to ten inferior labials, fifth or sixth superior and fourth, fifth, or sixth inferior largest, third and fourth or fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior longer than anterior. Scales on body in seventeen or nineteen rows, all keeled except sometimes the first row of each side. Anal plate not divided. Gastrosteges varying in number from one hundred and thirty-nine to one hundred and fifty-two. Urosteges in two series of from fifty-two to seventy. Eye small.

The ground color above is olive or pale blackish brown, dotted and spotted with black along the edges of the scales, and with or without three light longitudinal lines. The lateral lines, when present, are usually grayish or greenish blue, while the dorsal line—which often fades out posteriorly—may be white, gray, blue, yellow, or brick red. A blackish streak usually runs back from the eye in specimens light enough to show it. The labials are bluish gray or yellowish. The pineal spot is often present on the suture between the parietal plates. The belly may be yellowish, olive, plumbeous, or slate; the throat is yellowish white; the lower surface of the tail is sometimes brick red. Many specimens can be distinguished from *T. p. pickeringii* only by the smallness of the eye, which, however, is a very good character.

Length to anus..................	372	395	420	518	560	585
Length of tail..................	105	112	115	133	164	138

Distribution.—This beautiful little snake is very common in British Columbia and Washington in the vicinity of Puget Sound, especially on Vancouver Island and in King County. It has been noted from western Oregon and from California. The last locality needs confirmation, although this snake may, perhaps, occur in the northwestern corner of our State.

68.—Thamnophis elegans (Baird & Girard). ELEGANT GARTER SNAKE.

Eutainia ordinoides, B. & G., Cat. N. A. Rept., Pt. I, 1853, p. 33; GIRARD, U. S. Explor. Exped., Herp., 1858, p. 153, pl. XIV, figs. 1–4.

Eutainia elegans, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 34 (type locality **El Dorado County, Calif.**).

Tropidonotus trivittatus, HALLOW., Proc. Ac. Nat. Sci. Phila., VI, 1853, p. 237 (**Cosumnes River, Cal.**).

Eutænia elegans ordinoides, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 654.

Eutænia elegans brunnea, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 654 (type locality **Fort Bidwell, Cal.**).

Eutænia elegans lineolata, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 655 (part), (**no type**).

Eutænia infernalis infernalis, COPE, Proc. U. S. Nat. Mus., XIV., 1891, p. 657.

Eutænia infernalis vidua, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 658 (type locality **San Francisco, Cal.**).

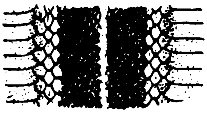
Tropidonotus ordinatus var. *infernalis*, BOUL., Cat. Snakes Brit. Mus., I, 1893, p. 207 (part).

Thamnophis infernalis, STEJN., N. A. Fauna, No. 7, 1893, p. 210.

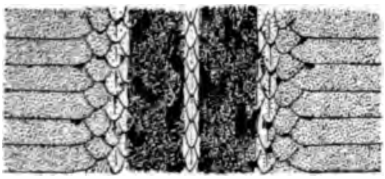
Description.—Head distinct from neck, flat-topped, with rather narrow, rounded snout, and temporal regions sometimes swollen. Rostral large, bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, supraocular of each side, a frontal, and a pair of parietals. Anterior and posterior nasals distinct. One loreal. One or rarely two preoculars and from two to four postoculars. Temporals normally one followed by two, sometimes 1–1 or 1–3. Eight, or very rarely seven, nine, or ten, superior and ten or eleven inferior labials, fifth or sixth superior and fifth, sixth, or seventh inferior largest, fourth and fifth or third and fourth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior equal to or little or much longer than anterior. Scales on body in nineteen or twenty-one rows. Anal plate undivided. Gastrosteges varying in number from one hundred and forty-four to one hundred and seventy-three. Urosteges in two series of from fifty-seven to eighty-nine. Eye moderate.

The head is brown or olive above, never red. The labials are yellow or olive. The chin and throat are yellow or yellowish white. The belly is yellow or olive, sometimes washed with brick red. The dorsal line is never bluish. There are four distinct types of coloration, each of which might be considered a distinct species if compared with typical specimens of the others, but all of which pass into one another almost imperceptibly when large series are examined. These types are:

(a) Similar to *T. vagrans*, the ground color being brown with three light lines, a pair of dark nuchal blotches, and numerous black or dark brown spots along the sides. This style of coloration is seen in young only, but many of the smallest specimens are unspotted.



(b) Black above, with three yellowish or grayish white lines, the lateral lines sometimes blended with the color of the belly. Baird's and Girard's type of *E. elegans* was of this style.



(c) Brown above, with three longitudinal lines; the dorsal line yellow; the lateral lines and more or less of the belly bright brick red.

(d) Dark olive above, with no lateral lines; the dorsal line yellow and very wide, the throat bright yellow, the belly deep olive or slate, with or without a yellow streak along its middle. This is Cope's *E. infernalis vidua.*

None of these forms occurs alone in any one place and the series of intergradations is complete, so that these cannot be recognized as geographical races. Nevertheless, the form (d) without lateral lines seems to occur nowhere else than on the coast slope of the San Francisco peninsula.

Length to anus	175	450	475	510	540	560
Length of tail	58	155	130	178	163	

Distribution.—The Elegant Garter Snake appears to be confined to California north of the Tehachapi Mountains. I have examined specimens from Shasta (Ft. Reading), Placer (Lake Tahoe), El Dorado, Tuolumne (Tuolumne Meadows), Mariposa (Tamarack Flat, Yosemite Valley), Fresno (Fresno, Pitman Creek), Tulare, San Luis Obispo, Monterey (Pacific Grove), Santa Cruz (Soquel, Wadell Creek, Glenwood), Santa Clara (Mt. Hamilton, Santa Clara, Stephen's Creek, Palo Alto), San Mateo (Pescadero, La Honda, Searsville), San Francisco (Lake Merced, Union Square), Alameda (Calaveras Valley, Oakland), Contra Costa (Mount Diablo), Marin, Lake (Middleton), and Mendocino (Pieta, Irishes, Sherwood's) Counties. In many parts of its range it occurs with the *T. parietalis*.

Habits.—Little known, but similar to those of *T. parietalis*.

69.—**Thamnophis vagrans** (Baird & Girard). WANDERING GARTER SNAKE.

Eutainia vagrans, B. & G., Cat. N. A. Rept., Pt. I, Serp., 1853, p. 35 (type locality **California**); GIRARD, U. S. Explor. Exped., Herp., 1858, p. 154, pl. XIV, figs. 5–10.

? *Eutaenia couchii*, KENN., U. S. Pac. R. R. Surv., X, Pt. IV, 1859, p. 10 (type locality **Pitt River, California**).

Eutænia elegans lineolata, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 655 (part) (**no type**).

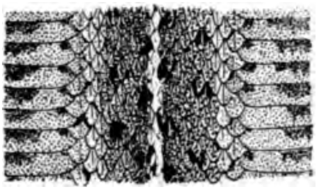
Eutænia elegans vagrans, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 656.

Tropidonotus vagrans, BOUL., Cat. Snakes Brit. Mus., I, 1893, p. 202.

Thamnophis vagrans, STEJN., N. A. Fauna, No. 7, 1893, p. 213.

Description.—Head distinct from neck, flat-topped, with narrow, rounded snout, and temporal regions sometimes swollen. Rostral large, bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals distinct. One loreal. One preocular. Two to four postoculars. Temporals normally one followed by two, sometimes 1–3. Eight superior and ten or eleven inferior labials, sixth in each series largest, fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior equal to or shorter than anterior. Scales on body in twenty-one rows, all keeled. Anal plate not divided. Gastrosteges varying in number from one hundred and fifty-two to one hundred and seventy-nine. Urosteges in two series of from fifty-three to ninety-one. Eye moderate.

The ground color above is olive or greenish yellow or brown. Along the middle of the back runs a yellow line of varying width. On the second and third rows of scales of each side is a similar yellow line. Any or all of these lines may be very indistinct or even absent. On each side of the back are two series of alternating black spots, the upper of which often encroach upon the dorsal line. These spots sometimes unite to form a zigzag band along each side, or may be obscured by the darkening of the ground color. The top of the head is usually light brown, with a yellow pineal spot. There is a pair of large dark nuchal blotches. The gastrosteges and urosteges are almost always more or less marbled with black or slate, especially near their anterior edges and along the middle of the belly. The chin and throat normally are yellowish white.



Length to anus	295	342	485	520	525	535
Length of tail	97	117	175	150	160	155

Distribution.—In California, the Wandering Garter Snake has been reported from Humboldt Bay, and is known to live on both slopes of the Sierra Nevada throughout the whole length of the chain. It ranges east across Nevada (Ash Meadows, Silver Creek, etc.) to Utah, and is common in Idaho (Salmon Mts., Birch Creek, Challis Valley, Alturas Lake, Trail Creek, Sand Point, Lewiston, Potlach Creek, Juliaetta, Wardner, Shoshone Falls, Ketcham, Blue Lake, Kootenai Co., Arco, Weiser, etc.). It crosses the border into British Columbia, and occurs in the eastern parts of Washington and Oregon, being replaced in the western portions of these states by its subspecies *T. vagrans biscutata.*

70.—**Thamnophis vagrans biscutata** (Cope). COPE'S GARTER SNAKE.

Eutænia biscutata, COPE, Proc. Ac. Nat. Sci. Phila., 1883, p. 21 (type locality **Klamath Lake, Oregon.***)

? *Eutænia Henshawi*, YARROW, Proc. U. S. Nat. Mus., VI, 1883, p. 152 (type locality **Ft. Walla Walla, Wash.**)

Description.—Differs from *T. vagrans* in having usually two or three (rarely one) preoculars, scales sometimes in twenty-three rows, and superior labials not infrequently seven.

The coloration usually is not different from that of typical *T. vagrans*. Some specimens, however, are so dark as to conceal the dorsal spots, and one is black everywhere excepting the chin, throat, and a few bits of skin between the scales, no lines being visible. Some dark specimens resemble, in coloration, certain examples of *T. elegans*.

Length to anus....................	375	455	500	503	550	620
Length of tail......................	132	135	155	175	175	175

Distribution.—This snake was first described from specimens collected at Klamath Lake, southeastern Oregon. I have examined specimens from that locality and from Vancouver Island, besides more than thirty from King County, Washington. Garter snakes are almost incredibly numerous in the Klamath region. That all belong to this subspecies seems improbable.

71.—**Thamnophis hammondii** (Kennicott). CALIFORNIA GARTER SNAKE.

Eutainia hammondii, KENN., Proc. Ac. Nat. Sci. Phila., 1860, p. 332 (type localities **San Diego, Fort Tejon, Cal.**); COPE, U. S. Explor. Surv. W. 100th Mer., V, 1875, pp. 545, 549.

Eutænia elegans couchii, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 656.

Tropidonotus ordinatus var. *hammondii*, BOUL., Cat. Snakes Brit. Mus., I, 1893, p. 210.

Thamnophis hammondii, STEJN., N. A. Fauna, No. 7, 1893, p. 212.

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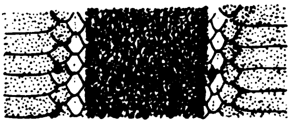
* See Cope, Proc. U. S. Nat. Mus., xiv, 1891, p. 651.

Description.—Head distinct from neck, flat-topped, with very narrow, rounded snout and temporal regions not infrequently swollen. Rostral large, bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head, a pair of internasals, a pair of prefrontals, a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals distinct. One loreal. One or two or three preoculars and three postoculars. Temporals one followed by two or three. Eight (rarely seven) superior and ten inferior labials, sixth in each series largest, fourth and fifth superior reaching eye, first pair of inferior meeting on median line. Two pair of geneials, posterior much longer than anterior. Scales on body in twenty-one, or rarely nineteen, rows. Anal plate not divided. Gastrosteges varying in number from one hundred and fifty-nine to one hundred and seventy-three. Urosteges in two series of from sixty-eight to eighty-five. Eye large.

The ground color is grayish brown or olive marked, in young specimens, with numerous black spots which usually disappear with age. The dorsal line is almost always absent, or represented by a yellow spot or short line on the neck, but in some specimens extends to the tail. The lateral lines are either distinct or blended with the color of the belly. Black spots are frequently present on the first row of scales and tips of the gastrosteges. The top of the head is olive, with a yellow pineal spot on the line between the parietal plates. Dark nuchal blotches are present. The lower surfaces are whitish or grayish yellow, sometimes barred with black between the plates, and rarely with a slight central shading of slate posteriorly.



Length to anus	304	382	440	500	670	870
Length of tail	93	109	120	143	180	275

Distribution.—Hammond's Garter Snake is confined to southern California, where it has been taken in San Diego (San Diego, Agua Caliente), Riverside (Hemet Valley, San Jacinto), San Bernardino (Ontario), Los Angeles (Los Angeles), Ventura (Santa Paula), Inyo (Owen's Valley), Kern (Fort Tejon, Kern River), Tulare (Kern River Lakes, Trout Meadows), and Fresno (Fresno) Counties.

Habits.—Like other members of its genus, this snake swims well and is usually found in or near water. Its food consists mainly of aquatic animals, such as fish, frogs, and tadpoles. One specimen was caught with a good-sized trout in its teeth. Captive individuals sometimes change their colors very quickly, in accordance with the lightness or darkness of the objects upon which they rest.

Family XIII. CROTALIDÆ.

The *Crotalidæ* or Pit Vipers are represented on the Pacific Coast and in the Great Basin by six kinds of rattlesnakes. These are our only poisonous serpents, and may be distinguished from the harmless forms by their possession of a pit in the side of the face between the eye and the nostril, and a horny, segmented rattle at the tip of the tail. They are provided with large plates along the belly, and the head is covered with small scales. The eye is well developed, with vertical pupil. There are no rudiments of limbs. Both jaws bear teeth, and near the front of the upper jaw are large, perforate, erectile poison-fangs.

Genus 37. CROTALUS.

Crotalus, Linnæus, Syst. Nat., 10 ed., 1758, 1, p. 214 (type **horridus**); "*Crotalophorus*, Houttuyn, Linn. Nat. Hist., VI, 1764, p. 290 (same type);" *Caudisona*, Laurenti, Syn. Rept., 1768, p. 92 (same type); "*Crotalinus*, Rafinesque, Am. Month. Mag., III, 1818, (p. 446), IV, p. 41" (same type); "*Uropsophus*, Wagler, Syst. Amph., 1830, p. 176 (type **triseriatus**)"; *Urocrotalon*, Fitzinger, Syst. Rept., 1843, p. 29 (type **durissus**); *Aploaspis*, Cope, Proc. Ac. Nat. Sci. Phila., 1861, p. 206 (type **lepida**); *Æchmophrys*, Coues, Surv. W. 100th Mer. V, 1875, p. 609 (type **cerastes**).

The head is broad and low, with flattened top, and is very distinct from the neck. Its upper surface is covered with scales, which are small except sometimes on the snout. The anal plate and most or all of the urosteges are undivided. The tail is short and ends in a horny rattle or button. The dorsal and most of the lateral scales are keeled.

SYNOPSIS OF SPECIES.

- a.—Rostral in contact with anterior nasal.
  - b.—Outer edge of supraocular plate normal, not raised into a horn-like process.
    - c.—Dark bands on tail black; light postocular line, if present, reaching row of scales next above supralabials in front of corner of mouth............................**C. ruber**.—p. 226.
    - c^2.—Dark bands on tail brown (rarely in part blackish); light postocular line, if present, reaching row of scales next above supralabials at corner of mouth if at all.
      - d.—Rostral not wider than high.
        - e.—Light postocular line one scale wide; dark postocular band arising below anterior corner of eye **C. confluentus**.—p. 218.
        - e^2.—Light postocular line more than one scale wide; dark postocular band, if distinct, arising below middle of eye.* **C. lucifer**.—p. 216.
      - d^2.—Rostral wider than high..........**C. tigris**.—p. 220.
  - b^2.—Outer edge of supraocular raised into a horn-like process. **C. cerastes**.—p. 222.
- a^2.—Rostral separated from anterior nasal by granular scales. **C. mitchellii**.—p. 224.

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* A narrow dark line sometimes runs forward from this point.

72.—Crotalus lucifer Baird & Girard. PACIFIC RATTLESNAKE.

?*Crotalus oregonus*, HOLBROOK, N. A. Herp., 2 ed., III, 1842, p. 21, pl. III (type locality **Columbia River**).

Crotalus lucifer, B. & G., Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 177 (type locality **Oregon and California**).

Crotalus confluentus, YARROW, Surv. W. 100th Mer., V, 1875, p. 530 (part); BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 576 (part).

Crotalus adamanteus atrox, STREETS, Bull. U. S. Nat. Mus., No. 7, 1877, p. 40.

Crotalus confluentus lucifer, COPE, Proc. Ac. Nat. Sci. Phila., 1883, pp. 11, 19, 22.

Crotalus lecontei, HALLOW., Rep. Pac. R. R. Surv., X, 1859, p. 18.

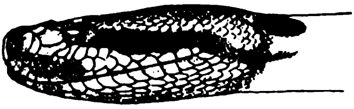
"*Crotalus adamanteus* var. *lucifer*, JAN, Elenco Sist. Ofid., 1863, p. 124."

Crotalus oregonus var. *lucifer*, GARMAN, Mem. Mus. Compr. Zool., VIII, 1883, p. 173.

Crotalus confluentus lecontei, COPE, Proc. U. S. Nat. Mus., XIV, p. 692.

Description.—Moderately large. Head broad, flat-topped, varying in outline according to position of fangs, etc. Rostral much higher than wide, in contact with anterior nasal. Two nasals. Usually two preoculars and four internasals. A large scale just in front of supraocular and occasionally large scales on prefrontal region. Supraocular large but not raised into a horn-like process, separated from its fellow by three to nine irregular rows of scales. Fourteen to seventeen superior and fifteen to seventeen inferior labials, first pair of latter in contact on median line in front of single pair of geneials. Two to four rows of scales between supralabials and eye. Scales in twenty-five to twenty-seven rows, keeled except in one to three rows of each side. Gastrosteges varying from one hundred and sixty-three to one hundred and eighty-nine. Urosteges sixteen to twenty-six, a few sometimes divided.

The ground color is brown, olive, gray, or dull yellow, marked along the back with a series of large dark brown blotches which become cross-bars or incomplete rings posteriorly. These blotches are often paler centrally than about their edges and vary greatly in shade, shape, amount of separation, and contrast with the ground color. Smaller alternating blotches are usually present on the sides. Many of the scales between or around the dark dorsal blotches are light—yellow, gray, or white. These colors often show between the lateral dark blotches also. Young specimens show a light transverse streak on the supraocular, usually not present in adults. A dark streak runs from the eye to the corner of the mouth, the line of its lower edge striking the eye about under the pupil, although narrow forward continuation may be present. This dark streak is bordered above by a light streak which is wider than the width of one scale and passes above the corner of the mouth. Another light streak crosses the side of the face below the dark one and usually is bordered in front by a dark brown patch on the side of the snout. Sometimes these markings are more or less completely obscured. The tail is provided with brown and light rings, a few of the former, near the tip of the tail, being occasionally blackish. The lower surfaces are white or yellow, more or less spotted or clouded with brown.



Length to anus..................	253	540	740	810	810	960
Length of tail to base of rattle...	22	35	43	64	85	77

Distribution.—The Pacific or "Black" Rattlesnake occupies all parts of California except the Colorado and Mojave Deserts. It ranges across Oregon and Washington to British Columbia. Farther east, it occurs in Idaho, along the Snake River, and has been taken in many parts of Nevada and even in Utah. Throughout most of this territory it is the only rattlesnake, but in southern California is found with *C. ruber*, and possibly meets *C. confluentus* in Idaho. In California it ranges from the floor of the San Joaquin Valley up at least to an altitude of 8,600 feet in the Sierra Nevada. I have examined specimens from San Diego (De Luz, Bonsall), Riverside (San Jacinto), San Bernardino, Kern (Delano), Tulare (Kern River, Sheep Meadows), Fresno, Monterey (Monterey, Jolon), Santa Cruz (Santa Cruz, Glenwood), Santa Clara (Black Mountain, Smith Creek, Mt. Hamilton, Los Gatos, Gilroy), Sonoma (Petrified Forest), Lake (Lower Lake), Counties, California; Klamath Falls, Oregon; and Twin Falls and Blue Lakes Cañon, Idaho.

Habits.—We have no special knowledge of the habits of this species. For an account of the rattlesnakes in general see Stejneger, Report of the U. S. National Museum for 1893.

73.—**Crotalus confluentus** Say. Prairie Rattlesnake.

"?*Crotalinus viridis*, Rafinesque, Am. Month. Mag., IV, 1818, p. 41."

Crotalus confluentus Say., Long's Exped. Rocky Mts., II, p. 48; Baird & Girard, Cat. N. A. Rept., Pt. I, Serp., 1853, p. 8; Stejneger, N. A. Fauna, No. 5, 1891, p. 111; Stejneger, Rep. U. S. Nat. Mus., 1893 (1895), p. 440; Boulenger, Cat. Snakes Brit. Mus., III, 1896, p. 576 (part).

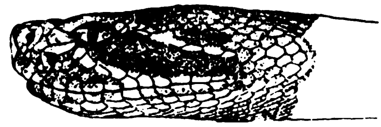
Crotalus lecontei, Hallow., Proc. Ac. Nat. Sci. Phila., VI, 1852, p. 180 (type locality **Cross Timbers**).

?*C. lucifer* var. *cerberus*, Coues, Surv. W. 100th Merid., V, 1875, p. 607 (type locality **San Francisco Mts., Ariz.**).

Crotalus confluentus var. *pulverulentus*, Cope, Proc. Ac. Nat. Sci. Phila., 1883, p. 11 (type locality vic. **Lake Valley, New Mexico**).

Description.— Moderate. Head broad, flat-topped, varying in outline according to position of fangs, etc. Rostral much higher than wide, in contact with anterior nasal. Two nasals. Usually two preoculars and four internasals. A large scale just in front of supraocular and occasionally large scales on prefrontal region. Supraocular large but not raised into a horn-like process,* separated from its fellow by from three to six irregular rows of scales. Fourteen to seventeen superior and a similar number of inferior labials; first pair of latter meeting in front of single pair of geneials. Two to four rows of scales between supralabials and eye. Scales in twenty-five to twenty-nine rows, keeled except in one to three rows of each side. Gastrosteges varying from one hundred and seventy-eight to one hundred and eighty-eight. Urosteges nineteen to twenty-eight.

The ground color is grayish or yellowish brown, marked along the back with a series of large, darker brown blotches which usually become cross-bars or incomplete rings posteriorly. These blotches are paler centrally than about their edges and vary greatly in shape and amount of separation. Smaller alternating dark blotches are usually present on the sides. Many of the scales between or around the dark dorsal blotches are light—gray or white. These colors sometimes show between the dark lateral blotches also. Many specimens show a light transverse streak on the supraocular. A dark streak runs from the eye to the corner of the mouth, the line of its lower edge passing in front of the eye or striking it about under its anterior corner. This dark streak is bordered above by a light streak which is not wider than the width of one scale and passes above



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*Garman mentions a specimen with horn-like supraocular.

the corner of the mouth. Another narrow light streak crosses the side of the face below the dark one, and is bordered in front by dark brown on the side of the snout. The tail is provided with brown and light rings or cross-bars, a few of the former, near the tip of the tail, being sometimes blackish. The lower surfaces are dull yellow or white, sometimes clouded with brown.

"The color varies greatly, being sometimes duller, sometimes brighter, lighter or darker, depending upon age, season, condition of skin, climate, and the predominating color of surroundings."*

Length to anus	595
Length of tail to rattle	37

Distribution.—"Broadly speaking, the Prairie Rattlesnake occupies the area bounded in the East by the ninety-sixth meridian and the Upper Missouri Valley; by the main divide of the Rocky Mountains in the West; by the thirty-third parallel in Texas and the Mexican boundary further west in the South; and by the fiftieth parallel in the north. * * * Although the main divide of the Rocky Mountains in this northern region seems to be the limit of its extension to the west, yet in at least one place where there is no high crest to obstruct its passage across, it has been found on the western slope, viz.: at Lemhi, Idaho."† It has not been taken in Nevada, nor in any of the Pacific States.

74.—**Crotalus tigris** Kennicott. TIGER RATTLESNAKE.

Crotalus tigris, KENN., U. S. Mex. Bound. Surv., II, Rept., 1859, p. 14, pl. IV (type locality **Sierra Verde and Poso Verde**); STEJNEGER, N. A. Fauna No. 7, 1893, p. 214; STEJNEGER, Report U. S. Nat. Mus., 1893, 1895, p. 449; BOULENGER, Cat. Snakes, Brit. Mus. III, 1896, p. 580 (part).

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* Stejneger. Report U. S. Nat. Mus. for 1893.

† Stejneger. Report U. S. Nat. Mus. for 1893.

Description.—Of moderate size. Head rather small, flat-topped, varying in outline according to position of fangs, etc. Rostral wider than high, in contact with anterior nasal. Two nasals. Usually two preoculars and four internasals. Supraocular large but not raised into a horn-like process; separated from its fellow by five to seven irregular rows of scales. About fourteen superior and thirteen to fourteen inferior labials; first pair of latter meeting in front of single pair of geneials. Three rows of scales between labials and eye. Scales in twenty-one to twenty-five rows, dorsals strongly keeled. Gastrosteges varying at least from one hundred and seventy-eight to one hundred and eighty-one. Urosteges nineteen to twenty-one.

The ground color is yellowish ash, varying from whitish to tawny, marked along the back with a series of rather small and indistinct brown blotches which become cross-bars or stripes posteriorly (whence the name *tigris*). These blotches are paler centrally than about their edges and sometimes are nearly obsolete. Smaller alternating blotches are present on the sides. "The head markings are rather indistinct, especially the postocular stripe, which is often lost in the dense sprinkling of minute black dots covering the sides of the head." The lower surfaces are yellow or white, sometimes faintly clouded with brown.

Length to anus	540
Length of tail to rattle	35

Distribution.—The Tiger Rattlenake " was formerly only known from a few localities in southern Arizona near the Mexican boundary, until in 1891 the Death Valley exploration under Dr. Merriam extended its range very materially into the desert mountains of southern California and Nevada south of the thirty-seventh parallel, from Owen's Valley to the Great Bend of the Colorado." The vertical range is at least from 2,000 to 6,500 feet above sea-level. Some of the localities at which this snake has been taken are: Rocky Creek, Independence Creek, Owens Valley, Coso Valley, Argus Range, Panamint Mountains, and Slate Range, California, and Vegas Valley, Vegas Wash, Indian Spring Valley, and Grapevine Mountains, Nevada.

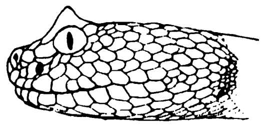
Habits.—This snake seems to be of partially nocturnal habits. It feeds upon small mammals, such as kangaroo rats and pocket mice. It probably mates in April.

75. — **Crotalus cerastes** Hallowell. HORNED RATTLESNAKE. SIDEWINDER.

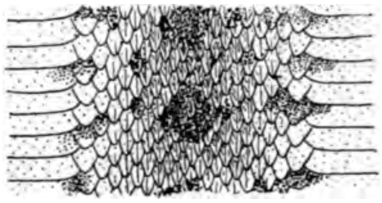
Crotalus cerastes HALLOW., Proc. Ac. Nat. Sci. Phila., 1854, p. 95 (type locality "**Borders of the Mohave River, and in the desert of the Mohave**") BAIRD, U. S. Mex. Bound. Surv., II, 1859, p. 14, pl. III; STEJNEGER, N. A. Fauna, No. 7, 1893, p. 216.

Æchmophrys cerastes, COUES, Surv. W. 100th Merid., V, 1875, p. 609.

Description.—Small. Head rather narrow, flat-topped, varying in outline according to position of fangs, etc. Rostral as broad as, or broader than, high, in contact with anterior nasal. Anterior and posterior nasals united, at least above nostril. Usually two preoculars and two internasals. Supraocular very large, raised into a horn-like process, separated from its fellow by from four to six irregular rows of scales. Eleven to thirteen superior and twelve to thirteen inferior labials, first pair of latter in contact on median line in front of single pair of geneials. Two or three rows of scales between supralabials and eye. Scales in twenty-one rows,



feebly keeled except in one to three lower rows on sides where smooth; those near middle of back with central tubercular swellings. Gastrosteges varying at least from one hundred and thirty-four to one hundred and forty-six. Urosteges sixteen to twenty-one, a few sometimes divided.



The general color above is gray, often with a yellowish or vinaceous tinge, with a series of rather small and indefinite blotches of grayish or yellowish brown. Smaller blotches or spots are usually present on the sides and on the tips of the gastrosteges. The supraocular shows an indistinct transverse streak. A brown streak runs from the eye to the corner of the mouth. The tail is ash-color with half rings of brown, which are much darker near its tip than anteriorly. The lower surfaces are yellowish white, sometimes faintly clouded with brown or gray.

Length to anus	415	440	450
Length of tail to rattle	38	42	31

Distribution.—The Sidewinder occupies the lower levels of the Colorado and Mojave Deserts, where the Tiger Rattler occurs in the mountainous districts, and ranges thence across western Arizona and southern Nevada to "southwestern Utah." In California it has been taken near Salton, in the Colorado Desert; at Lone Pine, in Owen's Valley; in Panamint Valley; at Borax Flat; at Bennett Wells, Death Valley; and at Pilot Knob. It is known to occur in Nevada in Pahrump, Vegas, and Indian Spring Valleys, at Sarcobatus Flat, in the Amargosa Desert, and in the valleys of the Virgin and Lower Muddy.

Habits.—In certain parts of its range, this species is very numerous. "Its local name is derived from its peculiar mode of progression: when disturbed it moves away sideways, keeping its broadside toward the observer, instead of proceeding in the usual serpentine manner. * * * * One was shot containing a kangaroo rat (*Dipodomys*) and two pocket mice (*Perognathus*). * * * * During the latter part of April and the early part of May these rattlesnakes were often found in pairs and were doubtless mating. At such times they remained out in plain sight over night instead of retreating to holes or shelter under desert brush, and on two occasions they were found by us on cold mornings so early that they were too chilled to move until considerably disturbed."*

76—Crotalus mitchellii Cope. BLEACHED RATTLESNAKE.

Caudisona mitchellii, COPE, Proc. Ac. Nat. Sci. Phila., 1861, p. 293 (type locality **Cape St. Lucas, Lower California**).

Caudisona pyrrha, COPE, Proc. Ac. Nat. Sci. Phila., 1866, pp. 308, 310 (type locality **Canon Prieto near Ft. Whipple, Arizona**); COUES, Surv. W. 100th Merid., V, 1875, p. 608, pl. XXII.

Crotalus mitchellii, COPE, Bull. U. S. Nat. Mus., No. 1, 1875, pp. 33, 92; VAN DENBURGH, Proc. Cal. Acad. Sci., (2), IV, 1894, p. 450; *Id. ibid.*, V, 1895, p. 159; STEJNEGER, Rep. U. S. Nat. Mus., 1893 (1895), p. 454.

Crotalus pyrrhus, STEJN., W. Am. Scient., VII, April, 1891, p. 165.

Crotalus Mitchellii pyrrhus, STEJN., Rep. U. S. Nat. Mus., 1893 (1895), p. 456.

Description.—Moderately large. Head rather small, with flattened top, varying in outline according to position of fangs, etc. Rostral either higher than wide or wider than high, separated from anterior nasal by one or two rows of granular scales. Usually two nasals. Supraocular large, somewhat projecting laterally, separated from its fellow by from four to eight scales.

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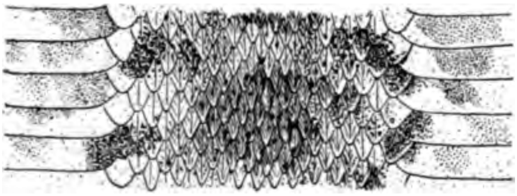
*Merriam, N. A. Fauna No. 7. 1893, p. 217.

Fourteen to seventeen superior and fourteen to eighteen inferior labials, first pair of latter meeting in front of a single pair of geneials. Three to five rows of scales between supralabials and eye. Scales in twenty-five or twenty-seven rows, keeled except sometimes in one or two rows of each side. Gastrosteges varying from one hundred and fifty-eight to one hundred and ninety-eight. Urosteges seventeen to twenty-seven, a few of the posterior sometimes divided.

The general color is white, gray, yellow, vinaceous-cinnamon, or salmon-red, minutely dotted with black or brown, and with a series of indefinite brown, black, or red blotches along the back. These dots and dorsal blotches, as well as smaller blotches which sometimes are present on the top of the head and on the sides, may be so faint as to cause the animal to be called the White Rattlesnake, or so dark as to produce a blackish effect; the blotches, however, never have definite outlines, appearing only as darker portions of the general "pepper and salt" style of coloration. A dark band sometimes runs down and back from the eye. The tail is gray, with black cross-bars. The lower surfaces are white or yellow, usually more or less clouded with brown.



Length to anus	710	770	810	840	870	930
Length of tail to rattle	62	74	72	60	71	90

Distribution.—This rattlesnake has been found in the Colorado Desert, near Mountain Springs, San Diego

County, California, and in the Mojave Desert. It has been taken in Arizona, and ranges the whole length of the peninsula of Lower California.

Habits.—This seems to be distinctively a desert species. Like other rattlesnakes, it is ovoviviparous. A specimen taken at San José del Cabo, in September, contained three young about 260 *mm.* in length.

77.—**Crotalus ruber** (Cope). WESTERN DIAMOND RATTLESNAKE.

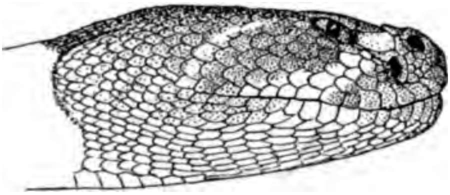
Crotalus adamanteus ruber, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 690 (type locality unknown.)

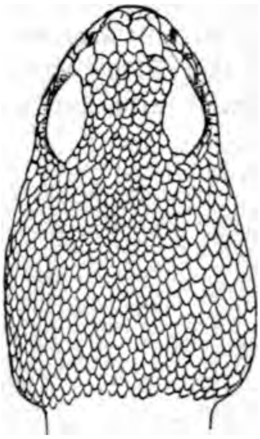
Crotalus atrox ruber, STEJNEGER, Rep. U. S. Nat. Mus., 1893 (1895), p. 439.

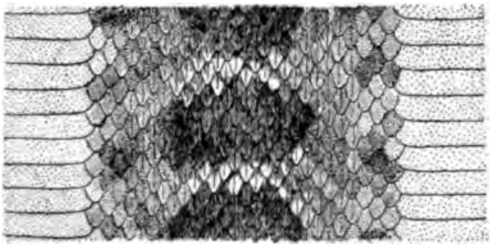
Crotalus ruber, VAN DENBURGH, Proc. Cal. Acad. Sci. (2), V, 1895, p. 1007.

Description.—Large. Head broad, flat-topped, varying in outline according to position of fangs, etc. Rostral usually higher than wide, in contact with anterior nasal. Two nasals. Usually two preoculars and two to four internasals. A large scale just in front of supraocular. Supraocular large but not raised into a hornlike process; separated from its fellow by six or seven irregular rows of scales. About sixteen or seventeen superior and seventeen to nineteen inferior labials; first pair of latter not meeting on median line in front of single pair of genials. About four rows of scales between supralabials and eye. Scales in twenty-seven to twenty-nine rows, of which one or two on each side are smooth. Gastrosteges varying from one hundred and eighty-six to one hundred and ninety-nine. Urosteges twenty-two to twenty-six.

The general color is light red, reddish cinnamon, or brownish yellow, with a series of large, darker blotches along the back. These blotches are sometimes very indefinite, especially toward the sides. On the middle of the back they are separated by light yellow or white. This light edging may or may not be continued onto the sides, where smaller indefinite dark blotches may often be seen. The head is unicolor above. A faint light stripe crosses the side of the face from the preocular plates to the mouth. The scales behind and above this light stripe are a little darker than the ground color and sometimes are set off posteriorly by a light line running down and back from the posterior corner of the eye and striking the supralabials in front of the corner of the mouth. The tail is ash-color, with from three to







five black rings or cross-bars. The lower surfaces are yellowish, often faintly clouded with light brown.

Length to anus	935	1080
Length of tail to rattle	55	75

Distribution.—This, the largest rattlesnake of the West, was first described from a specimen of unknown origin. It has since been found on the western slopes of San Diego and Riverside Counties, at Twin Oaks, San Jacinto, and De Luz.

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NEW MALLOPHAGA, III.

Comprising

MALLOPHAGA FROM BIRDS OF PANAMA, BAJA CALIFORNIA AND ALASKA,

BY
VERNON L. KELLOGG,
Professor of Entomology, Leland Stanford Junior University.

MALLOPHAGA FROM BIRDS OF CALIFORNIA,

BY
VERNON L. KELLOGG AND BERTHA L. CHAPMAN.

THE ANATOMY OF THE MALLOPHAGA,

BY
ROBERT E. SNODGRASS,
Assistant in Entomology, Leland Stanford Junior University.

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MALLOPHAGA FROM BIRDS OF PANAMA, BAJA CALIFORNIA, AND ALASKA.

(With Plates I-IV.)

BY VERNON L. KELLOGG.

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INTRODUCTION.

The Mallophaga described and identified in this paper were collected by Mr. R. C. McGregor (from the Panama birds), by Mr. J. F. Abbott (from the Baja Californian birds) and by Messrs. Cloudsley Rutter and A. W. Greeley (from the Alaskan birds), all these collectors being students of Stanford University. The birds in each case were obtained personally by the collector, and the Mallophaga taken from the freshly killed specimens or newly made skins. The determinations of the Panama birds were made by Mr. Robert Ridgway, curator of birds, U. S. National Museum; the determinations of the Baja Californian birds by Mr. W. W. Price, student of Stanford University, and the determinations of the Alaskan birds by the collectors.

The sequence of genera in the following paper does not indicate the author's views with regard to the natural relationships of these genera, nor even with regard to the phyletic rank of the suborders. The Amblycerous genera, coming last in the present arrangement, are undoubtedly the more generalized of the two subordinal groups. The squence is that adopted in the European monographs and followed by me in my two previous papers (New Mallophaga, I, 1896, and New Mallophaga, II, 1896), and is retained for the sake of uniformity. The sequence of the species of each genus is determined by the host, the sequence of hosts being that adopted in the Check-List of North American Birds (2nd Edition, 1895), published by the American Ornithologists' Union. The names of the hosts are those used in the Check-List.

Wherever a species of Mallophaga is met, which has been previously identified by me on an American host, reference is made only to this previous identification, where the synonymy, European hosts, and figure and measurements of the species are given.

Docophorus.

Docophorous lari Denny. (See Kellogg, New Mallophaga, I, 1896, p. 98, pl. iv, fig. 4.)

Specimens from *Larus* sp. (Baja California) and from *Larus glaucescens* (North Pacific Ocean, off Alaska). Taken previously by me from several species of *Larus* (Bay of Monterey, California.)

Docophorus icterodes Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 96, pl. iv, fig. 1).

Specimens from the Red-crested Merganser, *Merganser serrator* (Kodiak Island, Alaska). Previously taken by me from same host species and from seven other duck species (Kansas and California).

Docophorus cordiceps Giebel. (Plate I, fig. 2).

Insecta Epizoa, 1874, p. 103.

Docophorus glareolæ Giebel, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 312.

Docophorus nitzschia Giebel, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 312.

Docophorus mollis, Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss. 1861, vol. xviii, p. 312.

Docophorus frater Giebel, Insecta Epizoa, 1874, p. 103.

Docophorus cordiceps Giebel, Piaget, Les Pediculines, 1880, p. 80 and p. 664, pl. vi, fig. 2; Picaglia, Pediculini dell' istituto anat.-zool. d. R. Univ. d. Modena, 1885, reprint, p. 11.

A male, a female and a young specimen which may be referred to this species from *Tringa macularia* (Panama), and a male from *Tringa* sp. (Baja California). It is probable that Denny's *D. cephalus* (Monograph. Anoplur. Brit., p. 81, pl. ii, fig. 8; and Grube, Middendorff's Reise, 1851, p. 470) is this species.

The species may be recognized by its general dark coloration, broad head, short clypeus, and prominent and characteristic genitalia. I figure the male; Piaget has figured the female. The measurements of my specimens are as follows: male, body, length 1.6 mm., width .72 mm.; head, length .56 mm., width .62 mm.; female, body, length 1.65 mm., width .87 mm.; head, length .62 mm., width .75 mm.

Docophorus latifrons Nitzsch. (Plate I, figs. 5 and 8).

Germar's Mag. Entomol., 1818, vol. iii, p. 290.

Pediculus cuculi Fabricius, Syst. Ent., 1775, p. 807.

Pediculus fasciatus Scopoli, Entomol. Carniol, 1763, p. 383.
Docophorus latifrons N., Denny, Monograph. Anoplur. Brit., 1842, p. 97, pl. i, fig. 4; Giebel, Insecta Epizoa, 1874, p. 93; Piaget, Les Pediculines, 1880, p. 36, pl. ii, fig. 7.

Numerous specimens from a California Cuckoo, *Coccyzus americanus occidentalis* (Baja California), which are referable to this long-known *Docophorus* of the cuckoos, but on account of the markedly larger size, color differences, and other minor differences must be given a varietal name.

Var. *occidentalis* Kellogg. Male, body, length 2.06 mm., width .89 mm.; head, length .75 mm., width .75 mm. Female, body, length 2.5 mm., width 1.12 mm.; head, length .84 mm., width .85 mm. Piaget gives the following dimensions for *latifrons*: female, body, length 1.9 mm., width, .85 mm.; head, length .65 mm., width .6 mm. The male *latifrons* is 1.6 mm. long. My specimens have two long hairs on the temporal margins instead of one as described for *latifrons*, and have a distinct hair, not referred to in the descriptions of *latifrons*, in the posterior angles of the prothorax. The blotches on the ventral aspect of the abdomen of the males are with my specimens not oval, but transversely elongate, differing markedly from those of the female. The head and thorax of var. *occidentalis* are reddish brown, the ground color of the abdomen whitish, and the blotches blackish brown.

Docophorus californiensis Kellogg.

New Mallophaga, II, 1896, p. 483, pl. lxvi, fig. 6.

Eleven specimens from a Narrow-fronted Woodpecker, *Melanerpes formicivorous angustifrons* (Baja California). Type specimens taken from the Californian Woodpecker, *Melanerpes formicivorus bairdi* (Palo Alto, California).

Docophorus rufus n. sp. (Plate I, figs. 6 and 9).

A dozen specimens from the Ash-throated Flycatcher, *Myiarchus cinerascens nuttingi* (Baja California). A member, probably, of the group *femorati* of which *communis* is the chief representative. I have not found on my specimens the characteristic longish hair rising vertically from the dorsal surface of the anterior angles of the clypeus, but the broad clypeus, signature, genital blotches, and pustulated lateral abdominal blotches are of the *femorati* type. The species differs distinctly from *communis* in color, in the peculiar anterior convexity of the clypeus, in the extent of the transverse abdominal blotches, in the presence of transverse median blotches on the ventral aspect of the abdomen, and in the character of the genital blotches.

Description of the male. Body, length 1.56 mm., width .31 mm.; reddish brown, lighter on head and thorax, because the darker lateral abdominal blotches nearly cover the abdomen; broad headed; with ventral median transverse blotches on abdomen.

Head, length .5 mm., width .48 mm.; forehead broad, with expanded frontal uncolored part of clypeus flatly convex, with a shallow, median, curving emargination; no hairs on this frontal margin; sides of forehead with a pair of short hairs and a shorter single one in front of and near the trabeculæ; the trabeculæ very large, acute; antennæ when projected backward not quite reaching the occipital margin; the inconspicuous, slightly pendulous eyes with a hair, and two hairs on the flatly convex temporal margin; occipital margin nearly straight, bare; color, reddish brown; signature large, broad, anterior margin almost straight, the dark, sharp posterior point projecting beyond the mandibles;

antennal bands interrupted distinctly at the suture; occipital bands distinct, divergent, connected at base; ocular bands indistinct; trabeculæ weakly colored at base, uncolored distally; antennæ colored.

Prothorax quadrangular (as exposed), with a single hair in the posterior angles; posterior margin flatly convex; median part paler; lateral regions darker, and an indistinct posterior border. Metathorax rather short, posterior margin angulated, with a series of pustulated hairs; colored like the prothorax, paler in middle and with fairly distinct lateral borders. Legs concolorous with ground color of thorax, with small, darker, inconspicuous marginal markings. Sternal markings consisting of intercoxal lines and a very small median double blotch on prothorax. (Metathorax obscure).

Abdomen short, just as long as head and thorax; two to three long hairs in posterior angles of segments and numerous pustulated and other long hairs on dorsal surface; narrow, blackish, lateral bands; large dark brown lateral blotch, with clear stigmatal spots and about five pustulations along posterior margin, and leaving only a narrow median part of the abdomen uncovered; on segment 8 a complete transverse band; segment 9 rounded behind, with a narrow blackish posterior border, with a few longish hairs; genitalia showing through in segments 6–9; on ventral surface of segments 1-8 a large transverse median blotch reaching almost to the lateral margins.

Female. Body, length 1.94 mm., width .8 mm.; head, length .6 mm., width .56 mm.; the transverse blotches of abdomen but little smaller than those of male; segment 9 uncolored, with small brown lateral blotches, the posterior margin distinctly angularly emarginated;

ventral abdominal blotches smaller than those of male and not reaching so far laterally, those of posterior segments forming a genital blotch with broad, curving anterior part, narrower median part, and separate small lateral reniform parts.

Docophorus communis Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 486, pl. lxvi, fig. 7).

Several specimens from the Saint Lucas Cardinal, *Cardinalis cardinalis igneus* (Baja California). Taken previously by me from 16 species of passerine birds (Kansas and California).

Docophorus panamensis n. sp. (Plate I, fig. 1).

From a tanagrine bird, *Phœnicothraupis fuscicauda* (Panama). A *Nirmus*-like form but with distinctly long trabeculæ. By shape of head and thorax allied to the *angustifrontes* group of the woodpeckers; resembling my *D. jungens* (New Mallophaga, II, 1896, p. 481, pl. lxvi, fig. 4) from *Colaptes auratus* (Kansas).

Description of female. Body, length 1.75 mm., width .61 mm.; narrow, Nirmoid, whitish with distinct brown lateral bands on thorax and abdomen, and quadrangular lateral transverse blotches.

Head, length .5 mm., width .5 mm.; triangular, with narrow front, slightly emarginated; three short hairs on each side of the anterior half of the forehead, and three longer hairs and a prickle in front of the trabeculæ; the trabeculæ prominent, extending beyond the tip of first segment of the antennæ; the antennæ rather thick, segment 2 longest, with a prominent short spiny hair; eyes rather large, with a prickle; temporal margin

rounding, with one long hair and a few prickles; occipital margin slightly sinuous; forehead whitish with narrow brown antennal bands terminating at the suture; a palely colored broad suture with straight posterior margin and emarginated anterior border; whole hind head light brown with occipital margin very narrowly bordered with blackish brown.

Prothorax quadrangular, posterior angles rounded, with one hair, posterior margin flatly convex; whitish with dark brown lateral borders extending inward along the posterior margin. Metathorax angulated on abdomen, each latero-posterior side with nine long hairs (including the one in the lateral angle); lateral borders unevenly blackish brown; ground color of segment whitish tinged posteriorly with light brown, this posterior coloration interrupted by a median longitudinal whitish line. Legs very pale brown. Sternal markings consisting of distinct intercoxal lines, and faint traces of light brown median blotches.

Abdomen elongate-elliptical; a few longish hairs in posterior angles, and numerous weak long hairs on dorsal surface of segments in transverse series; ground color whitish with distinct, narrow lateral bands, darkest on anterior segments, and light brown, quadrangular, transverse lateral blotches on all segments, the two blotches of segment 8 meeting on the median line; segment 9 feebly emarginate, with no hairs on the posterior margin.

Docophorus domesticus Kellogg.

New Mallophaga, II, 1896, p. 475, pl. lxv, fig. 4.

A female and an immature specimen from the Black Martin, *Progne subis hesperus* (Baja California). Described from a Purple Martin, *Progne subis* (Lawrence, Kansas).

Docophorus laticeps Giebel. (Plate I, figs. 4 and 7).

Insecta Epizoa, 1874, p. 88.

Philopterus cincli Gervais, Hist. nat. d. Insectes aptères, 1847, p. 336.

Docophorus cincli Denny, Monograph. Anoplur. Brit., 1842, p. 85, pl. v, fig. 8.

Docophorus laticeps Giebel, Piaget, Les Pediculines, 1880, p. 65; Kœnig; Ein Beitrag zur Mallophagen-fauna, 1884, p. 3, pl. i, figs. 1-5; pl. ii, figs. 6, 7.

One adult female and two immature specimens from the American Dipper, *Cinclus mexicanus* (Kodiak Island, Alaska), which may be referred to this species, but which constitute a distinct variety characterized by the elongate, slender forehead with emarginated front. The species was found on *Cinclus aquaticus*, the European Dipper.

Var. *americanus* Kellogg. Female, body, length 2.06 mm., width .75 mm.; head, length .6 mm., width .5 mm.; thus being one-third longer than the species dimensions as given by Kœnig; head elongate, with narrow tapering forehead; front uncolored, with slight, narrowly rounded emargination; signature long, narrow, with posterior point reaching the mandibles; antennal bands distinct; trabeculæ long, slender; abdomen elongate-elliptical, with lateral triangular blotches with stigmatal spots and pustulations as in the species types; also, narrow blackish lateral bands; segment 8 wholly colored; ventral surface of abdomen with transverse median blotches; segment 7 with a narrower median blotch (touching blotch of segment 6) and two small lateral reniform blotches; segment 8 wholly colored or nearly so.

Docophorus rutteri n. sp. (Plate I, fig. 3).

A female and an immature specimen from an Oregon Chickadee, *Parus atri-capillus occidentalis* (Kodiak Island, Alaska). Denny has described two species of *Docophorus* from *Parus*, one, *pallescens* (Monograph. Anoplur. Brit., p. 82, pl. i, fig. 8) from *Parus palustris* and *P. major*, being based on immature specimens, and characterized by an emarginate clypeal front; the other, *pari* (ibid, p. 87, pl. vi, fig. 6) from *Parus caudatus*, *P. ater*, and *P. cæruleus*, being of chestnut ground color, without lateral abdominal blotches and with a subacuminate head, and without series of pustuled hairs along posterior margins of metathorax, in all of which diagnostic characters my specimen differs from *pari*. It agrees with it in hairy abdomen, acute trabeculæ, angulated metathorax, and general shape of abdomen.

Description of female. Body, length 2. mm., width .91 mm.; well marked with smoky brown blotches with large conspicuous pustulations, and many long hairs on dorsal aspect of abdomen.

Head, length .53 mm., width .6 mm.; a specially stiff, spiny short hair in each anterior angle of the flatly convex front, a hair before the suture and two before the trabeculæ; the trabeculæ long, slender, and weakly curving; antennæ when projecting backward barely reaching the occipital margin, with annulated segments; eye rather prominent, with a hair; a hair just behind the eye and three more on the rounded temporal angles; occipital margin weakly sinuous, the middle third slightly convex; signature large, distinct, with darker posterior acuminate point projecting beyond the mandibles, surrounded by a nearly uncolored region; antennal bands interrupted, widening at base; occipital bands distinct, blackish brown, diverging, and with anterior extremities reaching the blackish, distinct, curving, linear ocular blotches; region between the occipital bands pale; temples dark brown.

Prothorax small, short, margins rounding, with one long pustulated hair in posterior angle, another on posterior margin just a little inside of the angles, and four grouped together in the posterior median region of the segment; median region pale to uncolored, darkening laterally until the blackish lateral borders are reached. Metathorax roundly angulated on the abdomen; an unpustulated hair in the lateral angles and ten long hairs on each half of the posterior margin, rising from conspicuous pustulations; median region palest, lateral and posterior regions blackish brown, causing the clear pustulations to be very prominent. Legs smoky brown.

Abdomen oval; lateral angles projecting, with long hairs; dorsal surface of segments with single transverse series of long weak hairs; median region almost uncolored; prominent blackish brown, subtriangular, lateral, transverse blotches, with very conspicuous uncolored stigmatal spots and pustulations; segment 8 wholly colored, dark brown; segment 9 with small triangular lateral brown blotches; shallow, angular emargination behind.

Nirmus.

Nirmus punctatus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 109, pl. vi, figs. 1 and 2.)

Specimens from *Larus* sp. (Baja California). Taken previously by me from several species of *Larus* (Bay of Monterey, California).

Nirmus furvus Nitzsch. (Plate II, fig. 1).

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 374.

Nirmus furvus N., Burmeister, Handb. d. Ent., 1832, vol. ii, p. 427; Giebel, Insecta Epizoa, 1874, p. 163, pl. v, figs. 2 and 3; Piaget, Les Pediculines, 1880, p. 169, pl. xiv, fig. 3; Supplement, 1885, p. 25; Osborn, Insects Affecting Domestic Animals, Bull. 5, N. S., Div. of Ent., U. S. Dept. Ag. 1896, p. 225.

A male and a female from the Spotted Sandpiper, *Actitis macularia* (Panama). My specimens do not possess the median longitudinal uncolored line across the first six or seven segments of the abdomen, as described for the types of the species, and besides, are very much darker, and are without distinct lateral transverse blotches on the abdominal segments. They are, too, a distinctly wider and less slender form, the head averaging nearly one-fifth wider in both sexes. However, in the present uncertain status of the species *furvus* (see Piaget, Les Pediculines, p. 170) I refer my specimens to the species, distinguishing them by a varietal name. Piaget's variety *alpha* (Supplement, p. 25) from *Vanellus cayensis* has, like my specimens, no uncolored median abdominal line, but no reference is made to any such characteristic dark chestnut to smoky general coloration of the body, as is shown by my specimens. Osborn's specimen is from *Phalaropus tricolor* (Museum Iowa Agricultural College).

Var. *ravus* Kellogg. Male, body, length 1.18 mm., width .34 mm.; head, length .37 mm., width .28 mm. Female, body, length 1.43 mm., width .37 mm.; head, length .40 mm., width .31 mm. Both sexes dark chestnut-brown to smoky, without median uncolored line on any abdominal segment, and without distinct abdominal blotches.

Nirmus fissus Nitzsch. (Plate II, fig. 2).

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

Nirmus fissus N., Burmeister, Handb. d. Ent., 1835, vol. ii, p. 427; Denny, Monograph. Anoplur. Brit., 1842, p. 148, pl. x, fig. 6; Walckenær, Ins. Apt., 1844, vol. iii, p. 344.

Nirmus bicuspis N., Giebel, Insecta Epizoa, 1874, p. 155, pl. v, figs. 11 and 12; Piaget, Les Pediculines, 1880, p. 184, pl. xv, fig. 7.

Several specimens, including male, female and immature specimens, from *Tringa* sp. (Baja California). My specimens are larger than the types of *bicuspis* and offer distinct though minor differences. I have given them a varietal name.

Var. *major* Kellogg. Measurements. Male, body, length 1.61 mm., width .38 mm.; head, length .3 mm., width .31 mm. Female, body, length 1.87 mm., width .44 mm.; head, length .47 mm., width .33 mm. Differs from types of *fissus* (which were taken from "*Charadrius minor*") by having a hair in the eye, by having four pustulated hairs on each lateral half of the posterior margin of the metathorax instead of three, two being median and two being near the angle; by having the median longitudinal uncolored line of the abdomen limited to the first two segments, and by being markedly larger. Piaget's specimens of *fissus* are: length, male, 1.3 mm. to 1.4 mm.; female, 1.5 mm.

Nirmus fuscus Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 499, pl. lxvii, fig. 7).

Many specimens from a Sparrow Hawk, *Falco sparverius* (Panama), a Lower Californian Sparrow Hawk, *Falco sparverius peninsularis*, a Duck Hawk, *Falco peregrinus anatum*, and a Saint Lucas Redtail, *Buteo borealis lucusanus* (Baja California). Taken previously by me from three species of hawks at Lawrence, Kansas. The size of these specimens from Panama and Baja Californian birds corresponds with that of the specimens previously taken by me from the Kansas birds, and is fully one-third greater than that recorded for the European specimens. The American specimens are at least varietally distinct from the typical Old World forms. There are variations manifest among the American specimens but I have not enough material yet to attempt to distinguish varieties.

Nirmus splendidus n. sp. (Plate II, figs. 3 and 6).

Males, females and young from a Caracara, *Polyborus cheriway* (Baja California). Species of *Docophorus*, *Lipeurus*, *Menopon*, and *Colpocephalum* have been taken from *Polyborus* by the European authors, but heretofore no *Nirmus*. The new species is unlike any of the *Nirmi* yet described from raptorial birds. It is large and strikingly marked.

Description of the male. Body, length 2.19 mm., width .84 mm.; large, broad-bodied, whitish with prominent lateral transverse brown abdominal blotches; head and thorax almost entirely colored.

Head, length .62 mm., width .6 mm.; forehead broad between trabeculæ and narrowly parabolic in front; forehead with four short separated hairs on each side; trabeculæ rather large for *Nirmus*, antennæ short; eye large, prominent, with a long hair, and with a fine prickle just behind it; temporal margins flatly convex, with two very long hairs; occipital margin straight; whole head strongly colored with exception of a pale, broad, clypeal, sutural line, and a short median longitudinal line leading from it backwards to the mandibles; the antennal bands narrow, and a little darker than general color of head, running entirely around frontal margin of head, although paler and nearly "interrupted" at the clypeal suture; trabeculæ nearly uncolored.

Prothorax short, oblong, with one hair in posterior angles; segment almost wholly colored. Metathorax short, the whole thorax being little more than one-half the length of the head; obtusely angulated on abdomen; posterior margin with a series of long hairs; segment mostly colored, darkest in median region; a broad white posterior border. Sternal markings consisting of inconspicuous intercoxal lines, and a small, indistinct median blotch on metathorax. Legs pale, though tinged with brown, with distinct, dark brown marginal markings.

Abdomen ovate; posterior angles of segments 1 and 2 without hairs, of segment 3 with a single hair, and of succeeding segments with two hairs; dorsal surface with numerous longish hairs; whitish with distinct lateral transverse blotches, each, with a clear stigmatal spot and some pustulations on segments 1–7; segment 8 with a curving, continuous brown transverse blotch; segment 9 rounded behind, with numerous longish hairs; uncolored except where the chitinized genitalia show through. Ventral surface all whitish except for a well defined and characteristic brown genital blotch on segments 7–9 (see fig. 6, pl. ii).

Female. Body, length 2.37 mm., width .97 mm.; head, length .62 mm., width .62 mm.; the increased size of the female is due to the larger abdomen, the head and thorax being of about the same size in both sexes; lateral abdominal blotches are not so long as in the male; segment 9 is shorter, bears two small blotches, and is slightly emarginated behind.

Nirmus atopus n. sp. (Plate II, fig. 4).

From a bird of the cuckoo family (Cuculidæ), *Piaya cayana thermophila* (Panama). This new form is one of the circumfasciate *Nirmi* of the general character of Rudow's *alchatæ* (Piaget, Les Pediculines, p. 165, pl. xiii, fig. 12) and allied forms. The few described members of this group have been found on columbine and gallinaceous birds.

Description of female. Body, length 1.84 mm., width .63 mm.; abdomen expanding posteriorly to segment 6; pale brownish white with brown lateral abdominal and thoracic bands and circumfasciate head.

Head, length .59 mm., width .53 mm.; forehead broad, rounded in front, with very few very fine hairs on the margin; trabeculæ small but distinct, acute; antennæ slender, with segment 5 longer than segments 3 or 4; temples rounded, with two long hairs and two or three very fine prickles on margins; eye without a hair, not especially prominent; occipital margin straight, bare; ground color of head whitish with small, inconspicous brown ocular blotches, temples very narrowly margined with brown, and rather broad chitin band, subtranslucent brownish along the entire front and lateral margins of forehead, and ending posteriorly in small elliptical expansions directed diagonally inwards.

Prothorax very short, quadrangular; lateral margins straight; posterior angles rounded, with one long hair; posterior margin straight; lateral borders brownish, the coloring extending along the posterior margin of the segment. Metathorax pentagonal, lateral margins bare, posterior margin obtusely angled on abdomen, with one hair in latero-posterior angle and four pustulated hairs in two pairs, one pair almost in the latero-posterior angle on each lateral half of the margin; lateral borders blackish brown, the color extending inward, but paling, in latero-posterior angles. Legs of pale ground color of the body, with narrow dark marginal markings. Sternal markings consisting of intercoxal lines, a small triangular blotch on mesothorax which fits like an apex to a larger pentagonal blotch on the metathorax.

Abdomen widening posteriorly to segment 6, then tapering bluntly; posterior segments with weak longish hairs in posterior angles; numerous weak, longish hairs on dorsal aspect in the broad median uncolored longitudinal line; lateral bands brown, distinct, extending posteriorly only through segment 7; pale brown, quadrangular, lateral, transverse blotches; last segment convex behind, with a very slight median emargination.

Nirmus virgatus n. sp. (Plate II. fig. 5).

Males and females from an icterine bird, *Amblycercus holosericeus* (Panama). Much like *N. illustris* Kellogg (New Mallophaga, II, p. 494, pl. lxvii, fig. 4), from the Red-winged Blackbird, *Agelaius phœniceus* (Lawrence, Kansas), and like *ornatissimus* Giebel (Insecta Epizoa, p. 144). The new form has a narrower front with the anterior angles not rounded, and does not possess the distinct bands internal to the antennal bands of the head of *illustris*. The lateral bands of the abdomen are wider, and the lateral transverse abdominal blotches are much more clearly indicated.

Description of male. Body, length 1.28 mm., width .47 mm.; whitish with striking broad black lateral borders of thorax and abdomen, black antennal and ocular bands, chestnut-brown outlines of transverse, lateral abdominal blotches on dorsal aspect, and chestnut-brown transverse median blotches on ventral aspect of abdomen.

Head, length .37 mm., width .37 mm.; front truncate or with a very shallow concavity; a few small hairs on sides of forehead; trabeculæ long; antennæ slender, segment 5 distinctly longer than either segments 3 or 4; eye distinct, slightly pendulous; temples not much expanded, margins flatly rounded, with one long hair and a few prickles; occipital margin straight; ground color whitish to uncolored; broad black antennal bands running to anterior angles of head and bending in angularly at base of trabeculæ; rest of forehead and trabeculæ uncolored; no colored clypeal signature; antennæ with segment 1 uncolored, other segments entirely blackish brown; ocular bands narrow, blackish; anterior part of temporal margins narrowly blackish; a brown, shield-shaped occipital signature showing through; mandibles and œsophageal sclerite showing through, brown.

Prothorax quadrangular, with rounded posterior angles with one hair in angle; segment whitish with broad lateral blackish brown borders. Metathorax angulated on abdomen; lateral angles obtuse; five long hairs on each latero-posterior margin; segment whitish, with uneven broad blackish lateral borders. Legs whitish with blackish brown blotches and semiannulations. Sternal markings consisting of distinct, chestnut-brown intercoxal lines, with expanded inner ends touching a small median blotch.

Abdomen elongate-ovate, with not very long hairs in posterior angles, and two hairs on the posterior margin of the dorsal aspect of each segment; ground color clear to whitish; broad lateral bands, from which project inwards the outlines of lateral transverse blotches which are oblong on segments 2–6, and tapering on segments 7–8; on the ventral aspect each segment has a chestnut-brown median blotch which shows through above; segments 8 and 9 are narrow; segment 9 projects narrowly backward, is narrowly but flatly rounded behind, and is mostly colored.

Female. Body, length 1.5 mm., width .53 mm.; head, length .41 mm., width .43 mm.; the head is a little wider in proportion to its length than in the male; last segment with distinct triangular lateral blotches and angularly emarginated behind.

Nirmus peninsularis n. sp. (Plate II, fig. 9).

Numerous specimens from a Phainopepla, *Phainopepla nitens* (Baja California). A member of the difficult group *interrupto-fasciati*, to which belongs my species *vulgatus* (New Mallophaga, II, p. 496, pl. lxvii, fig. 5), from seven passerine species, *simplex* (l.c., p. 492, pl. lxvii, fig. 2) from the Robin, *Merula migratoria*, and the strongly marked species *eustigmus* (l.c., p. 493, pl. lxvii, fig. 3) from Anna's Humming-bird, *Trochilus annæ*. The species from *Phainopepla* resembles most closely *brachythorax* Giebel (Insecta Epizoa, p. 134) from *Ampelis cedrorum*.

Description of female. Body, length 1.86 mm., width .41 mm.; long, slender, pale, with narrow marginal markings on head and intercoxal lines showing through on thorax.

Head, length .37 mm., width .31 mm.; elongate-triangular, with bluntly rounded apex; marginal hairs of forehead inconspicuous; trabeculæ small, uncolored but distinct; antennæ when projected backward reaching the occipital margin of head; eye not prominent, with a prickle; temples straight, with a single long hair in obtuse angle between temporal and occipital margin; occipital margin very flatly convex, ground color whitish; a blackish brown narrow lateral border on temples and forehead, this border turning in angularly at antennal fossa; front of clypeus uncolored and an indistinct, uncolored elongate-oval fossa widening posteriorly; mandibles and œsophageal sclerite showing through pale brown; no occipital border.

Prothorax quadrangular, with slightly convex, lateral and posterior margins; posterior angles with one small hair; ground color whitish, a blackish brown blotch in anterior angles, and posterior margin weakly bordered by the intercoxal lines of ventral surface showing through. Metathorax in outline a semicircle with anterior curving part slightly flattened and posterior margin slightly convex; posterior angles with three long pustulated hairs and three shorter, weaker, non-pustulated ones; one of the long hairs is in the apex of the angle, the other hairs are ranged along the posterior margin near the angle; segment whitish with darker anterior marginal markings. Sternal markings consisting of distinct intercoxal lines. Legs concolorous with thorax, with dark brown dorsal marginal markings.

Abdomen elongate, subparallel sided; segments 1 and 2 without hairs in posterior angles, segments 3–6 with one to two short, weak hairs in angles; segment 7 with three hairs in angles, and segments 8 and 9 with a few weak, curving hairs; segment 9 very short, with slight emargination; segments 5 and 6 with a hair on dorsal surface on each side rising from the posterior margin of segment just inward from the lateral band; dorsal surface otherwise naked; color of abdomen whitish, with narrow translucent lateral bands, each segmental portion passing the suture anteriorly.

Male. Body, length 1.34 mm., width .37 mm.; head, length .33 mm., width .26 mm.; being thus markedly shorter than the female; abdomen widening distinctly posteriorly, so that segment 5, which is widest, is more than one and one-half times as wide as segment 1; segment 8 short and much contracted within segment 7; segment 9 truncate behind; the genitalia showing indistinctly through segments 7–9; an indistinct, median pale brownish coloring on all segments.

Nirmus interpositus n. sp. (Plate II, fig. 7).

Three females from Vieillot's Warbler, *Dendroica bryanti* (Panama). A member of the group *interrupto-fasciati*, intermediate in markings between *N. vulgatus* Kellogg (New Mallophaga, II, p. 496, pl. lxvii, fig. 5), from several passerine birds from California and Kansas, and *eustigmus* Kellogg (l.c., p. 493, pl. lxvii, fig. 3), from *Trochilus annæ*, California. In size the new species is shorter than *vulgatus* but of the same width, and is both shorter and narrower than *eustigmus*. In general outline of body it resembles *eustigmus* more than *vulgatus*, but differs from *eustigmus* in having the sixth abdominal segment widest instead of the fourth.

Description of the female. Body, length 1.41 mm., width .41 mm.; whitish with distinct, broad, black, lateral abdominal bands and thoracic borders; head nearly equilaterally triangular.

Head, length .31 mm., width .34 mm.; outline of head nearly that of an equilateral triangle; the lateral margins of the head are weakly convex outward and the apex is parabolically curved; there are five or six short, inconspicuous hairs on each lateral margin of the forehead; the trabeculæ extend to the end of the first antennal segment and are uncolored; eye with a prickle; temporal margins with one long hair in the apex of the rounded, nearly right angle; occipital margin bare, very flatly convex; ground color whitish with a faint golden brown tinge; forehead and temporal margins narrowly bordered with blackish brown; front of clypeus uncolored; antennæ uncolored; occipital margin not bordered or only very narrowly and indistinctly so, an indistinct, pale brown, shield-shaped occipital signature showing through.

Prothorax very short, widely rectangular; a single longish hair in posterior angles; color whitish, with the intercoxal lines of under side showing through, and distinct blackish brown lateral borders. Metathorax short, lateral margins bare, sinuous; posterior margin flatly convex, with six or seven longish hairs on each half beginning in the posterior angle; whitish, with an uneven, blackish brown lateral border, and the strongly colored intercoxal lines of underside showing through. Legs whitish with blackish brown dorsal marginal markings. Sternal markings consisting of distinct intercoxal lines and indistinct pale median blotches.

Abdomen narrowest anteriorly, widening posteriorly to segment 4; segments 4–6 about same width, segment 7 slightly narrower, segments 8 and 9 short; short, weak single hairs in posterior angles of segments 3–7, with one or two shorter, weaker hairs in segments 5–7; dorsal surface with no or very inconspicuous hairs; whitish with distinct, rather broad, blackish brown lateral bands on segments 1–7, the segmental parts of the bands passing the suture and separated by nearly uncolored narrow spaces; covering the middle region of segments 6–7 a large, pale brown, shield-shaped blotch; segment

8 with a transvervse blotch, pale brown, darker outwardly, and behind not reaching the lateral margins; segment 9 with two very small pale brown linear lateral blotches, and feebly emarginated behind.

Nirmus audax n. sp. (Plate II, fig. 8).

From the yellow-headed Tit, *Auriparus flaviceps* (Baja California). A member of the group *interrupto-fasciati*, of darker ground color and with much more pronounced abdominal blotches than is usual in this group (see *vulgatus* Kellogg, New Mallophaga, II, 1896, p. 496, pl. lxvii, fig. 5).

Description of female. Body, length 1.6 mm., width .58 mm.; rather short and broad for *Nirmus*, especially of the *interrupto—fasciati* type; brownish ground with dark lateral blotches on thorax and abdomen, and blackish lateral bands and marginal markings.

Head, length .38 mm., width .41 mm.; the outline being nearly that of an equilateral triangle with blunted and curving apex and slightly convex legs; the marginal hairs of the forehead are few and very small; trabeculæ distinct, uncolored; temporal margins with a long hair in the rounded angle and several prickles; occipital margin weakly concave laterally and weakly convex in the middle; anterior part of forehead with nearly uncolored ground, with two brownish linear blotches bounding the oval fossa laterally; rest of head brownish with darker lateral borders and suggestions of occipital and ocular bands; antennæ colored.

Prothorax short, rectangular, with a single hair in posterior angles; color pale brownish in the middle, with the lateral regions dark brown, darkest on lateral margins. Metathorax angulated behind, with several strong hairs along each latero-posterior margin; latero-anterior margins bare, convex. Color brownish, paler in middle, stronger laterally and posteriorly, with uneven, blackish latero-anterior borders, and latero-posterior borders nearly uncolored. Legs brown with paler regions at extremities of segments and blackish dorsal margins, sternal markings consisting of distinct intercoxal lines, those between pro- and mesocoxæ with angulated spurs nearly touching; between the metacoxal lines a median blotch.

Abdomen short and broad, in shape an ellipse, segment 4 being the widest; ground color very pale brownish; segments 1–7 with narrow black lateral bands, the segmental parts distinct and passing the suture; quadrangular brown lateral blotches darkest internally on segments 1–7; segment 8 wholly colored; segment 9 uncolored and weakly emarginate behind; ventral surface of segments with a brown median blotch, the blotches of segments 6–7 fusing.

Lipeurus.

Lipeurus confidens n. sp. (Plate III, fig. 1).

Four females from a Black-footed Albatross, *Diomedea nigripes* (North Pacific Ocean). A species which in outline of body, color and markings is very like Piaget's species *tricolor* (Les Pediculines, p. 363, pl. xxx, fig. 4) from *Diomedea fuliginosa* (collection in the Museum of Leyden), but which is one and one-third times as large, without circumfasciate antennal bands, without occipital bands, with metathorax not without hairs as described for *tricolor* but with longish hairs in the posterior angles, without median abdominal blotches, and with last segment of female not acutely but bluntly two-pointed.

Description of female. Body, length 4.13 mm., width 1.03 mm.; large, whitish with sharply defined, black marginal markings, the lateral abdominal bands consisting of segmental pairs of contiguous subtriangular blotches.

Head, length .81 mm., width .7 mm.; subtriangular, widest just behind the eyes; front parabolic, with uncolored margin without hairs; a longish hair at the suture, with three in front of it (the foremost the longest) and two behind it on each side of the forehead; antennæ rather elongate, slender, segment 1 large and as long as segment 2; anterior angles of antennary fossæ acute but projecting little; the fossæ shallow; eyes prominent; temporal margins most convex just behind the eyes, obtusely angulated behind, and bearing a single weak hair and a few short spines; occipital margin nearly straight, bare; ground color whitish; strong, blackish brown antennal bands interrupted at the suture, widening posteriorly and extending back as far as the eye; two triangular blotches on occipital margins appearing as pointed continuations of the lateral bands of prothorax; antennæ uncolored.

Prothorax, as exposed, short, quadrangular, with flatly convex posterior margin and a longish spine in each posterior angle; color whitish, with even, strong, blackish lateral borders, turning in for a little distance at posterior angles. Metathorax with lateral concavities and five hairs in posterior angles, four of these hairs being long, strong, colored, and set closely together in a small uncolored space; posterior margin straight or even slightly concave; segment whitish with uneven, broad lateral borders, widest in middle and not reaching the posterior angles. Legs uncolored except for the chestnut-brown tarsi. No sternal markings.

Abdomen, fourth segment widest; segments of about equal length; posterior angles with few weak, not long, hairs; color whitish, with very narrow, clear lateral margin which sends expanded processes inward, three in each segment; the foremost of the three is the smallest and is contiguous to the suture; the hinder two are covered by two triangular blackish blotches which on some segments are contiguous, on others distinctly separate; segments 8 and 9 narrow, colored laterally; posterior margin of segment 9 truncate, with a very small angular emargination; two short hairs on each of the blunt points.

Lipeurus densus Kellogg. (Plate III, fig. 2).

New Mallophaga, I, 1896, p. 114, pl. vii, figs. 1 and 2.

A single male from a Black-footed Albatross, *Diomedea nigripes* (North Pacific Ocean, off Alaska). This specimen is a full millimeter longer and is much more completely blotched with dark brown than the original type specimen, a female; but I think they are of the same species. The female described is undoubtedly not fully grown and colored. While the antennæ vary in the sexes, that of the male bears no projection: it is simply heavier and larger, with its first segment largest; in the female, segment 3 is the longest. It is a male of this species, probably, which Taschenberg (Die Mallophagen, 1882, p. 145, pl. v, fig. 1*a*) describes and figures as the female of *ferox*.

Description of male. Body, length 5.8 mm., width 1.25 mm.; ground color very pale brown, but body mostly covered by large, dark brown blotches, head and thorax slightly longer than abdomen.

Head, length 1.3 mm., width 1.06 mm.; front parabolic, with a group of three distinct hairs at each side and two or three shorter ones along margin in front of antennary fossæ; antennæ large, long, (almost 1 mm.), without projection on any segment; segment 1 largest and other segments successively decreasing in width and length, uncolored except for an indefinite brownish annulation on segment 2; eyes projecting, conspicuous; temporal margins slightly expanded, rounded behind, with one short, weak hair and a few prickles; ground color brownish white; even, blackish brown antennal bands running around in front, the small portion of clypeus lying in front of the band being dark subtranslucent brown; temporal regions bounded within by diverging occipital bands, all blackish brown, these blotches acutely pointed in front and almost reaching to, but distinctly separate from, the bases of the antennal bands; on the forehead a dark brown lateral blotch on each side and in front of the mandibles.

Prothorax short and quadrangular as exposed; two short, weak hairs in posterior angles, one lying in on posterior margin; narrow median region of segment whitish, widest behind; lateral portions of segment blackish brown, paling inwardly. Metathorax large, long, with lateral margins concave, posterior margin weakly and flatly concave; a single short, weak hair in the apex of the posterior angles, and five longer, stronger, light brown hairs in a very small elongate-elliptical, uncolored space near the apex of the angles; segments all blackish brown, except a whitish, bluntly pointed, arrow-head-shaped, median region; projecting laterally from the posterior tip of this whitish space is on each side a small, linear, whitish space. Legs long, strong, coxæ nearly uncolored; femora dark brown, with uncolored extremities and tibiæ mostly colored. Sternal markings, prosternum with narrow, pericoxal lines; mesosternum with a rather large, brownish, median blotch; metasternum with weak indications of a median blotch.

Abdomen short, nowhere broader than thorax, with subparallel sides until segment 7 is reached, when the posterior tapering is begun; segments 1–6 of about equal size; segment 7 longer than others; segments 8–10 successively narrower and shorter; an uncolored median longitudinal line extending whole length of abdomen, rest of surface colored blackish brown by large quadrangular lateral blotches, which have clear stigmatal spots and are palest along inner margin; last segment angularly emarginated, with three short hairs on each point; segments 1–4 with a single very short hair in each posterior angle, segments 5–9 with longer hairs.

Lipeurus forficulatus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, pl. ix, figs. 3, 4, 5 and 6).

Many specimens from a Californian Brown Pelican, *Pelecanus californicus* (Baja California). Taken previously by me from same host species (Bay of Monterey, California).

Lipeurus gracilicornis Piaget. (Plate III, fig. 3).

Les Pediculines, 1880, p. 309, pl. xxv, fig. 6.

Many specimens including males, females, and young from a Man o'War Bird, *Fregata aquila* (Panama). My specimens, to which I give a varietal name, differ from Piaget's types (taken from *Fregata minor*), as described, in three important particulars, viz., character of antennæ, metathoracic hairs, and size. In other particulars the specimens from the two bird species agree well.

Var. *major* Kellogg. Measurements (Piaget's measurements of the type specimens are in parentheses), male, body, length 3.12 mm. (2.5 mm.), width .37 mm. (.29 mm.); head, length .66 mm. (.58 mm.), width .39 mm. (.29 mm.) Female, body, length 3.10 mm. (2.4 mm.), width .69 mm. (.53 mm.); head, length .69 mm. (.63 mm.), width .50 mm. (.41 mm.) Distinctly larger than the types of the species; third segment of antenna of male with an appendage; metathorax with six long hairs, five together and one alone. I figure the female as Piaget has figured the male of the species type.

Lipeurus protervus n. sp. (Plate III, fig. 4).

Many specimens from a Willow Ptarmigan, *Lagopus lagopus* (Kodiak Island, North Pacific Ocean). On this Ptarmigan were some specimens of *Goniodes mammillatus* Rudow, found by me on the California Partridge, *Callipepla californica* (New Mallophaga, II, 1896, p. 509, pl. lxix fig. 2), but this *Lipeurus*, while of similar general character to *Lipeurus docophoroides* Piaget taken by me from *Callipepla californica* (New Mallophaga, II, 1896, p. 508, pl. lxviii, fig. 8), is distinctly of another species. The most readily noticeable difference is in the character of the lateral abdominal blotches, those of *docophoroides* leaving a comparatively wide, unblotched median region, while those of the new species leave but a narrow, median, unblotched line. The blotches of the first segment meet in the new species; they do not, even nearly, in *docophoroides*.

Description of female. Body, length 2 mm., width .72 mm.; short and broad, and sub-Docophoroid in form; whitish ground color with nearly completely colored head and thorax, and abdomen with large, lateral, quadrangular blotches.

Head, length .5 mm., width .5 mm.; front rounded, with four very small, inconspicuous hairs on each side; trabeculæ small, distinct, acute, uncolored; antennæ rather short, segment 2 longest, segment 5 longer than 3 or 4, segments 4 and 5 colored, others uncolored or very weakly colored; eye large, with a hair; temples widest just behind the eyes; temporal margins converging posteriorly, nearly straight, with two long hairs and prickles; occipital margin concave; head pale brown in median region, temples, occipital border, and antennal bands with rim around the front, dark brown; a pale, almost uncolored transversal linear space in front of the mouth, and a similarly pale U-shaped space bounding the median region of the hind-head.

Prothorax small, short, quadrangular as exposed, with a single long hair in each rounded posterior angle; segment wholly brown except an uncolored posterior border. Metathorax small, not as long as broad, posterior margin obtusely angled on abdomen; two long pustulated hairs in a clear space on posterior margin near the lateral angles and two long pustulated hairs in a clear space on posterior margin midway between lateral angles and posterior angles; whole segment brown except a small, angular, median, whitish or uncolored space on anterior margin. Legs pale brown with narrow dark brown marginal markings. Sternal markings consisting of intercoxal lines and a shield-shaped median blotch on metasternum.

Abdomen elliptical, posterior angles of segments projecting slightly and with one to two longish weak hairs; ground color whitish with large quadrangular lateral brown blotches on segments 1–7, these blotches nearly meeting inwardly and separated intersegmentally by a whitish space about one-half as large as a blotch; the outer margins of the blotches are blackish, forming narrow lateral bands; each blotch with a stigmatal spot, and a few (three or four) pustulations at inner end, in which are seated longish hairs; a long hair arises from a demi-pustulation on the posterior margin of each blotch just behind the stigmatal spot; segment 8 wholly colored and segment 9 nearly so; posterior margin of last segment minutely emarginated.

Lipeurus macgregori n. sp. (Plate III, figs. 5 and 6.)

Numerous specimens from three individuals of the Ani, *Crotophaga sulcirostris* (Panama). This striking *Lipeurus* with its small Nirmoid body, and, except for the antennæ, Docophoroid head, shows no near resemblance to any other *Lipeurus* so far described.

Description of the male. Body, length 1.81 mm., width .56 mm.; short and broad for *Lipeurus*, Nirmoid in shape, head with slightly expanded anterior border of clypeus uncolored, and slightly emarginated as with many *Docophori*; ground color of body whitish with strong, dark brown, lateral borders of head, and lateral, transverse blotches of thorax and abdomen.

Head, length .53 mm., width .47 mm.; thus nearly as broad as long, triangular, with sinuate sides and truncated apex; anterior border of clypeus slightly expanded, uncolored, feebly emarginate; seven or eight distinct, rather long hairs on lateral margin; an angular concavity on lateral margin midway between trabecula and anterior angle; trabeculæ prominent; antennary fossæ deep; eye prominent, almost pendulous, with a hair in it and a prickle just behind it; temporal margins convex, with three long hairs, a fourth one on occipital margin of temple; occipital margin sinuous, bare; antennæ long and large, segment 1 heavy, nearly as long as the rest of the segments together; segment

2 next largest and longest, segment 3 with simple appendage at distal extremity, segments 4 and 5 short, subequal; color whitish, with strongly colored, dark brown temples, angulated antennal bands, and lighter brown, distinct signature, pointed behind, straight in front; mandibles and œsophageal sclerite showing through dark brown; trabeculæ and antennæ paler smoky brown.

Prothorax short, quadrangular, wider than long, with one pustulated hair in posterior angle; a large, nearly square, dark brown, lateral transverse blotch nearly covering each lateral half of the segment, the broad, median line between them whitish. Metathorax short, but little longer than prothorax; posterior margin nearly straight, with five long pustulated hairs ranged along each lateral fourth, the inner two of the hairs may have only demi-pustulations. Sternal markings consisting of distinct, blackish brown intercoxal lines, and a pale brown, indistinct median blotch on metathorax. Legs pale smoky brown with darker margins and semiannulations.

Abdomen elongate-ovate; segment 1 conspicuously narrower than metathorax; one or two short hairs in posterior angles of anterior segments, two or three long hairs in angles of segments 5–9; ground color whitish with broad, dark brown, lateral, transverse blotches on segments 1–7, these blotches subquadrangular, but narrower inwards, and leaving only a broad, median, whitish, longitudinal line on middle of abdomen; in this whitish space a few longish hairs on each segment; rather large, uncolored, stigmatal spots in the transverse blotches of segments 2–7; the transverse blotch on segment 8 continuous across the segment and curving; segment 9 with two backward-projecting, short, horn-like processes, dark brown, and a narrowly rounded, uncolored posterior border; genitalia extending through segments 6–9 and strongly chitinized.

Female. Body, length 2.41 mm., width .78 mm.; head, length .6 mm., width .53 mm.; considerably larger; abdomen more elongate; antennæ rather long, slender, segment 2 longest; lateral, transverse blotches of abdomen less tapering inwards; blotches of segment 8 distinct; segment conspicuously emarginate behind.

Goniodes.

Goniodes mammillatus Rudow. (See Kellogg, New Mallophaga, II, 1896, p. 509, pl. lxix, fig. 2).

Specimens from the Ptarmigan, *Lagopus lagopus* (Kodiak Island, off Alaska). Previously taken by me from a Californian Partridge, *Callipepla californica* (Mountain View, California).

Eurymetopus.

Eurymetopus taurus Nitzsch. (See Kellogg, New Mallophaga I, 1896, p. 135, pl. xi, figs. 3, 4, 5 and 6).

Specimens from the Black-footed Albatross, *Diomedea nigripes* (North Pacific Ocean, off Alaska). Previously taken by me from *Diomedea albatrus* (Bay of Monterey, California).

Trinoton.

Trinoton luridum Nitzsch. (See Kellogg, New Mallophaga I, 1896, p. 152, pl. xiii, fig. 4).

Specimens from a Green-winged Teal, *Anas carolinensis* (Kodiak Island, off Alaska). Previously taken by me from same host species and six other duck species (Kansas and California).

Colpocephalum.

Colpocephalum abbotti n. sp. (Plate IV, fig. 9).

Taken from a gull, *Larus* sp. (Baja California). This new form is of the general type of *fuscipes* Piaget (Les Pediculines, p. 567, pl. xlvii, fig. 7) from *Larus dominicanus*, and of *funebre* Kellogg (New Mallophaga, I, p. 147, pl. xii, fig. 7) from *Larus glaucescens* (Bay of Monterey). It most nearly in general aspect, and especially in the branching, uncolored median line of abdomen, thorax, and head, resembles *sulcatum* Piaget (Les Pediculines, p. 565, pl. xlvii, fig. 5) from *Sterna nigra*, but is one-half larger, and has transverse series of hairs on the dorsal aspect of the abdomen, while *sulcatum* is here naked.

Description of female. Body, length 2.34 mm., width .88 mm.; rather large, long abdomen; abdomen sombre in color with narrow, black, lateral borders on hind head, thorax, and abdomen; a conspicuous, uncolored, median line on first five segments of abdomen, all of thorax, and hind head, the line dividing in the head and sending a branch to each lateral margin just in front of the ocular emargination.

Head, length .47 mm., width .7 mm.; front broad, very flatly convex, with numerous hairs of which four are longer than the others; on the lateral margins of the forehead in front of the ocular emargination a very long hair, with another shorter one close to it, and two in the angle; the palpi projecting beyond the lateral margins of the head; the ocular emargination deep, angular, with a prominent fringe and a longish hair rising just inward of the double eye; temples rather narrow, projecting, with four long hairs on the margin and one rising at some distance inward from the occipital margin; six uncolored spots on the forehead, from two of which single long hairs arise and from the remaining four short hairs; occipital margin flatly concave, bare; head smoky brown with narrow black occipital border and curved ocular blotches; a broad, short-stemmed, uncolored Y, the prongs slightly angulated in the middle and terminating broadly in front of the eyes; the stem interrupts the black occipital border and is continuous with a median, uncolored, longitudinal line which traverses the thorax and the first few abdominal segments.

Prothorax broader than long, with obtuse lateral angles containing one longish hair and a spine in the apex of the angle, and a second longish hair arising from a little within and back of the apex; the latero-posterior margins bare, with a single longish hair in the slight angle which may be taken to separate the latero-posterior margin from the true posterior margin; two longish hairs on each half of the flatly convex posterior margin; color smoky brown with narrow black border on latero-posterior margins and on visible parts of latero-anterior margins; the small, slightly curving, longitudinal chitin bars at ends of the indistinct, usual transverse bar are black; the ground color of the segment is darker in posterior half, and the segment is bisected longitudinally by the median, uncolored line Metathorax with a fairly distinct suture setting off the mesothorax; lateral margins bare; posterior angles with a hair and spines; posterior margin straight, with four weak hairs not on the very margin; color smoky brown with narrow black lateral borders. Legs slightly lighter than segments, and with ill-defined, darker marginal markings. Sternal markings distinct, a median shield on prothorax; a small, elongate, rather

cone-shaped median blotch on mesothorax, and a large, broadly diamond-shaped, median blotch on metathorax; intercoxal lines between pro- and mesothorax distinct.

Abdomen elongate-elliptical; segments with a single long weak hair and some short ones in posterior angles, and some short ones along lateral margins; a single transverse series of not very closely set weak hairs along posterior margin of each segment; general color light smoky brown with very narrow blackish lateral bands; last segment parabolic behind, with short hairs, and at each side a few longish hairs.

Colpocephalum spineum n. sp. (Plate IV, fig. 1).

A single male from a Man o'War Bird, *Fregata aquila* (Panama). Piaget has taken a small *Colpocephalum* from *Fregata minor* (*angulaticeps*, Les Pediculines, p. 569, pl. xlvii, fig. 8), to which this new form must show some resemblance in size and characteristic quadrangular shape of forehead; but the shape of the abdomen, not at all elliptical as described for *angulaticeps*, but elongate-oblong with nearly parallel sides, and the distinct and characteristic abdominal markings and lateral hairs of the prothorax, serve to make any reference of my specimen to *angulaticeps* impossible.

Description of male. Body, length 1.53 mm., width .44 mm.; elongate, narrow, with subparallel sides; pale golden brown with large dark brown head blotches and lateral brown blotches on abdomen.

Head, length .34 mm., width .47 mm.; forehead nearly quadrangular, with a few short hairs along the front and four short ones and two longish ones on sides; palpi and antennæ slightly projecting beyond the margin of the head; temples broad with flatly convex lateral margins bearing numerous hairs of various lengths, two at least being long; occipital margin broadly concave; pale golden brown with broad blackish brown occipital border, greatly expanded triangularly at bases of the occipatal bands; ocular blotches large, and a distinct blotch on each side of the front rami of the mandibles extending diagonally to the front margin.

Prothorax short, with a spine and longish hair in each lateral angle and four longish hairs and two spines along each lateral half of the posterior margin. Metathorax longer and wider than prothorax, almost as wide as abdomen; several spines in a double row along the lateral margins, some strong spines in the lateral angles, and a series of ten or twelve strong hairs along the nearly straight posterior margin, whole thorax of pale brown ground color of body. Legs concolorous with the thorax, with dark brown markings near distal extremity of femur and on tibiæ. No distinct sternal markings.

Abdomen slender, elongate, with nearly parallel sides, with one long hair in posterior angles of segments 3–8 and numerous short hairs along lateral margins; dorsal surface covered with short spiny hairs, a series along the posterior margin of each segment being composed of longer but still spine-like hairs; color pale golden brown, the sutures whitish, and distinct subelliptical dark brown lateral blotches on segments 3–8, giving the abdomen a strikingly marked character; segment 9 but little narrower than segment 8 and broadly truncate behind; posterior margin with several long hairs and more shorter ones; dorsal surface with a transverse series of longish hairs.

Colpocephalum maculatum Piaget. (Plate IV, fig. 2).
Les Pediculines, 1880, p. 516, pl. xliii, fig. 1.

A male and a female from a Caracara, *Polyborus cheriway* (Baja California), which I refer with much doubt to this species of Piaget, taken from a *Polyborus brasiliensis* (Zool. Garden of Rotterdam). Piaget says that *maculatum* much resembles *C. flavescens*, the common *Colpocephalum* of raptorial birds (see Kellogg, New Mallophaga, II, 1896, p. 525 pl. lxxi, fig. 4). My specimens do not resemble *flavescens* at all closely, lacking the cross bands of the abdomen, being rather differently shaped, etc. But Piaget's description and figure of *maculatum* show it also to differ from *flavescens* in these and other particulars. My specimens measure: Male, body, length 1.62 mm., width .66 mm.; head, length .34 mm., width .53 mm. Female, body, length 2. mm., width .72 mm.; head, length .34 mm., width .53 mm.

Colpocephalum subæquale Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 525, pl. lxxii, fig. 1).

Specimens from an American Raven, *Corvus corax sinuatus* (Baja California). Taken previously by me from *Corvus americanus* (Palo Alto, California).

Colpocephalum diffusum n. sp. (Plate IV, figs. 3 and 4).

A well marked species found upon a surprisingly large number of widely related bird species from Panama. Mr. McGregor brought specimens from the following birds: *Amblycercus holosericeus*, *Arremonops striaticeps*, *Saltator albicollis*, *Phœnicothrampis fuscicauda*, *Elainea subpagana*, *Dendroica bryanti*, *Piaya cayana thermophila* (2 specimens), *Chiroxiphia lanceolata*, and *Ardea virescens* ! From the condition of affairs I should suspect straggling, but Mr. McGregor informs me that the birds were shot and the parasites collected on different days. We seem to have here a condition similar to the condition shown by *Docophorus communis.* In the list of hosts of this *Colpocephalum*, however, there are bird species of several unrelated families such as the Fringillidæ, Cuculidæ, Ardeidæ.

The specimens of the parasite vary somewhat in strength of color and hence distinctness of bands and blotches. Some of the weaker colored specimens, however, are evidently pupæ or freshly moulted adults. I have described the markings as shown in some well colored specimens from *Amblycercus holosericeus.*

Description of the male. Body, length 1.28 mm., width .53 mm.; ground color very pale, with distinct, blackish brown markings on head, thorax, and abdomen; transverse bands of abdomen uneven in size, the first and last bands being much larger than the middle ones.

Head, length .34 mm., width .47 mm.; a few short hairs on frontal margins; palpi barely projecting; ocular fringe distinct; temples broad, with a few long hairs; color whitish with prominent blackish ocular blotches projecting forward and connecting by a weakly colored, uneven broad line with the small but distinct blackish clypeal blotches; temples clear without dark margin; occipital margin narrowly bordered with blackish in the median part.

Prothorax; the part of the prothorax not concealed by the head is almost of the shape of a semicircle, a little flattened at the pole; the lateral angles lie very close to the occipital margin of the head, are obtuse, and bear three spines; there are three longish hairs on each lateral half of the rounded posterior margin; the segment is almost whitish with indications of darker borders and indistinct lines caused by the sternal markings showing through. Metathorax pentagonal, posterior margin straight, with four longish hairs and a spine (between the first two) on each lateral half; the posterior angles with two spines; color whitish with dark brown anterior angles, and sternal markings indistinctly showing through. Legs concolorous with thorax, with brownish and blackish markings. Sternal markings distinct, blackish brown, consisting of a median wedge-shaped blotch on prosternum connected by lateral processes with the intercoxal lines; a peculiar four-appendaged blotch on mesosternum composed of median blotch and meso-peri-coxal lines; and a pale median metasternal blotch with darker intercoxal lines.

Abdomen short, broadly elliptical, not turbinated; two or three distinct spines in posterior angles of segments; longish hairs in the angles and on the dorsal surface; segment 1 large; segments 2 and 3 not so large but larger than segments 4–7; segment 8 larger than segment 2 or segment 3; broad blackish brown lateral bands with the sutures distinct; no transverse bands on dorsal surface, but those of ventral surface showing through; these transversal bands arranged as follows: a single broad band covering all of segment 1 and anterior half of segment 2, narrow bands on segments 3–7, and one continuous band or blotch covering all of segments 8 and 9; the genitalia strongly chitinized, conspicuous, and extending through segments 2–9; last segment rounded behind, with a few short hairs; on the ventral surface of segment 2, a group of four very strong, long spines near each posterior angle.

Female. Body, length 1.56 mm., width .66 mm.; head, length .34 mm.; width .5 mm.; abdomen more elongate and the segments differently shaped; segment

1 very long, with straight posterior margin; segment 2 a little shorter, with distinctly curving posterior margin; segment 3 still shorter, with curving margin; segments 4–7 very short; segment 8 longer; ventral bands about as in male, with the last great band or blotch reaching anteriorly, with convex anterior margin, into segment 5.

Menopon.

Menopon titan var. **linearis** Kellogg.

New Mallophaga, I, 1896, p. 163, pl. xv, fig. 2.

Many specimens from a Californian Brown Pelican, *Pelecanus californicus* (Baja California). Described from same host species from Bay of Monterey, California.

Menopon auri-fasciatum n. sp. (Plate IV, fig. 5).

From a Man o' War Bird, *Fregata aquila* (Panama). Not at all like *M. intermedium* Piaget (Les Pediculines, p. 497, pl. xl, fig. 4) from *Fregata minor*.

Description of female. Body, length 2.19 mm., width 1.03 mm.; whitish with golden yellow transverse abdominal bands; dorsal surface of abdomen with many strong hairs in transverse series.

Head, length .31 mm., width .7 mm.; half-moon shaped, with smooth, even convex border; two short hairs on the front on each side of the middle, and two longish hairs and three shorter ones on each side in front of the antennal cavity; four very long hairs and several short ones in each temple; occipital margin concave, with six rather long hairs; pale yellowish white with black ocular flecks and small brown blotches just inside of the antennary cavities.

Prothorax rather large, with three short spines and a long hair along the narrowly rounded margin of the lateral angles, and five long hairs on each lateral half of the flatly rounding posterior margin; the lateral margins narrowly darker than the rest of segment, which presents no blotches; the uncolored transverse chitin bar is distinct, and the curving longitudinal bars at its extremities are darker than general color of segment. Metathorax as short as or shorter than prothorax, with very slight lateral emargination; lateral posterior angle with several small spines, and posterior margin, which is flatly convex, bears, beginning in lateral angles, two long hairs, then a spine, then eight long hairs, on each lateral half; a narrow transverse pale brown blotch runs across the segment near the posterior margin and expands at its lateral extremities. Legs of pale ground color of thorax with narrow darker marginal markings.

Abdomen ovate, rather turbinate, with longish hairs in the posterior angles of the segments and a single series of strong hairs across the dorsal aspect of each segment, ranged along the posterior margin of a pale brown transverse band which extends entirely across each segment; this band covers only about one-half the dorsal aspect of each segment, the uncovered half being of the whitish ground color of the general body, ninth segment flatly convex behind, with fringe of uncolored fine hairs, and with a few long hairs at lateral rounded angles.

Menopon striatum n. sp. (Plate IV, fig. 6).

Six specimens from a Willow Ptarmigan, *Lagopus lagopus* (Kodiak Island, North Pacific Ocean). Nearly twice as large as Grube's *M. lagopi* from *Lagopus alpinus*, though in general appearance the species must be similar. Grube describes the temples of *lagopi* with but one long hair; *striatum* has four, and the prothorax of *lagopi* is figured by Grube as being extraordinarily long.

Description of female. Body, length 2.22 mm., width .91 mm.; well marked, with entire transversal abdominal bands, with wide, whitish intersegmental spaces, and distinct, blackish, narrow lateral bands.

Head, length .3 mm., width .66 mm.; broadly parabolic in front, with slight rectangular orbital emargination; half a dozen short hairs on each lateral margin of forehead and three long hairs in region just in front of orbital emargination; the palpi projecting, as also the antennæ; temples narrow, five longish hairs, two more rising from occipital margin of temporal region; occipital margin concave, straight in the middle; ground color light brown, palest in median region, with very narrow blackish occipital border, blackish curving ocular blotches, and transversal dark brown bar in mandibular region.

Prothorax rather large, long; lateral angles obtuse, with three spines; posterior margin, from angle to angle, making a flattened semicircle and bearing 14 long hairs; ground color pale smoky brown, regions of lateral angles distinctly darker, transverse chitin bar dark, narrow, with a spine rising from each extremity; curving chitin bars at extremities of the transverse bar distinct, narrow. Metathorax with a broad whitish sutural space separating the small colored mesothoracic region from metathorax; metathorax with nearly straight posterior margin, and a series of hairs along straight posterior margin of broad chestnut-brown; transverse bar with narrow blackish lateral borders. Legs pale to smoky brown, with narrow, blackish dorsal

marginings and conspicuous spiny hairs. Sternal markings consisting of pale brown linear transversal blotch on prosternum, distinct, narrow blackish diagonal intercoxal lines between pro- and mesolegs, with pale brown median triangular blotch emarginated on anterior margin, very pale, indistinct intercoxal lines between meso- and metalegs, with a pale brown triangular median blotch between them, and another smaller pale brown median blotch apparently between the metacoxæ, really on first abdominal segment.

Abdomen elongate-elliptical; two to three or four longish hairs in lateral angles of segments; on segments 1–8 a regular series of alternating whitish (sutural) and chestnut-brown transversal (segmental) bands, each colored band bearing a single series of longish hairs on small pustules along its posterior margin; a longer hair on larger pustule at each end of each of these series; narrow, segmentally interrupted blackish lateral bands, separated from the brown transverse bands by a narrow whitish space; segment 9 wholly chestnut-brown except pale to uncolored posterior border; posterior margin with thick-set fringe of uncolored longer and shorter hairs. Ventral surface of abdomen of segments 2–8 with a median pale brown transversal band, bearing numerous fine hairs rising from small pustules; segment 9 mostly colored.

Menopon præcursor n. sp. (Plate IV, fig. 8).

Many specimens from a Gila Woodpecker, *Melanerpes uropygialis* (Baja California). Denny is the only author who has hitherto described a *Menopon* from the woodpeckers (*M. pici*, from *Picus viridis*, Monograph. Anoplur. Brit. p. 219, pl. xx, fig. 5). From his brief description and strange illustration I cannot determine whether my specimens resemble his or not.

Description of the female. Body, length 1.56 mm., width .75 mm.; golden brown, with chestnut-brown transverse abdominal bands.

Head, length .28 mm., width .58 mm.; being thus twice as wide as long; very few short hairs along front; from a partly clear spot on the dorsal surface on each side of the forehead three hairs arise of which one is very long; the palpi project by the length of the terminal segment; no distinct ocular fringe; the temples narrow and bearing three very long hairs and two or three shorter ones; occipital margin weakly concave, with six longish hairs, two being median; ground color of head pale subtranslucent brown, with nearly uncolored temples; black ocular flecks, irregular brownish ocular blotches, and a very narrow blackish occipital border. On the ventral surface are two backward-projecting, segmented, pointed, chitinous processes arising apparently at about the origin of the labial palpi.

Prothorax large, the obtuse lateral angles projecting even with the insertion of the last of the three long occipital hairs; the lateral margins and posterior margin (separated by a very obtuse but obvious angulation) with a few longish, slightly pustulated hairs (two on each lateral margin and six on the posterior margin); a spine in each lateral angle; the regions of the lateral angles smoky, with narrow blackish border on lateral margin; the straight, transverse chitin bar uncolored, the curving, longitudinal chitin bars blackish; middle region of segment concolorous with middle region of head. Metathorax short, but little wider than prothorax; posterior margin straight, with a series of longish hairs; region of posterior angles and an indistinct transverse blotch entirely across segment darker. Legs concolorous with the pale ground color of the body, with very narrow darker dorsal margining. Sternal markings consisting of a narrow transversal median blotch on prosternum, and intercoxal lines curving backward at inner ends on mesosternum.

Abdomen rather short and broad, ovate; posterior angles projecting but slightly and bearing two to three long hairs; on the lateral margins of each segment a spine; a transverse series of hairs across each segment near its posterior margin; ground color very pale yellowish brown, with a chestnut-brown transverse band entirely across each segment except the ninth; posterior margin of segment 9 flatly angulated and with a close fringe of hairs.

Male. Body, length 1.34 mm., width .6 mm.; head, length .25 mm., width .53 mm.; the few specimens of males in the lot taken from the single bird examined are paler in color than the females; the transverse band of the eighth abdominal segment is hardly noticeable; segment 9 flatly rounded behind, with a few prominent hairs.

Physostomum.

With regard to the characters used in distiguishing species in this genus I am in much doubt. I believe that the genus is not at all well undertsood and that the specific determinations including my own (see New Mallophaga II, 1896, p. 513, *et. seq.*) need a thorough revision. This revision cannot, however, be undertaken until much more material is in hand. I describe the two following species with this doubt in mind, simply giving here as best I can additonal data, for the reviser. In the case of the two species here described, the unrelated hosts accredited to each suggest that we have to do in this genus with a few species of wide range of host, or with many species of very similar appearance.

Physostomum pallens n. sp. (Plate IV, fig. 7).

Specimens from a Prothonotary Warbler, *Protonotaria citrea* and from a Flycatcher, *Elainea subpagana* (Panama).

Description of female. Body, length 3.6 mm., width .87 mm.; pale buffy brown, with blackish brown head markings and thoracic markings and lateral abdominal bands.

Head, length .67 mm., width .66 mm.; front slightly expanded, flatly rounded; with laterally projecting palettes; several short prickle-like hairs in the slight ocular emargination; temples projecting backward, acute, with three long hairs, one on margin just behind the eye, and two close together on dorsal surface near the margin farther back; color whitish to clear with usual brown longitudinally arranged lateral blotches.

Prothorax hexagonal, front and posterior margins concave; a long hair and two spines in each lateral angle, and a long hair and two or three spines on each lateral margin near the posterior angles; lateral margins unevenly bordered with blackish brown, interrupted by a nearly uncolored spot in each lateral angle. Metathorax longer than prothorax, with straight posterior margin, and a single hair and spine in each posterior angle; a slight, rounded swelling behind anterior angles bearing spines; blackish brown, narrow, even, submarginal, longitudinal bands. Legs uncolored.

Abdomen parallel-sided, with a single hair and spine or prickle in posterior angles of segments; whitish with distinct, even, blackish brown submarginal longitudinal bands; vulva flatly rounded, with fringe of fine hairs; posterior margin of last segment flatly rounded, with fine, uncolored hairs.

Physostomum invadens n. sp.

Specimens from a woodpecker, *Melanerpes wagleri* and from *Chiroxiphia lanceolata* (Panama). The finding of this species on *Melanerpes* is the first recorded occurrence of *Physostomum* on a non-passerine bird.

Description of female. Body, length 3 mm., width .81 mm; pale translucent brownish with dark brown to blackish head and thoracic markings and lateral abdominal bands; in outline and structural characters very like *pallens*.

Head, length .66 mm., width .6 mm.; almost identical with that of *pallens*; ground color browner; the hairs of ocular emargination rather longer and fewer. Prothorax with lateral angles hardly apparent, but marked by the presence of a long hair and spine. Legs with a little brownish coloring. Abdomen with longer hairs and more in posterior angles of segments, and with two hairs on posterior margin of each segment just a little distance inward from posterior angle. Lateral bands of abdomen rather broad and marginal; in each of these broad brown longitudinal bands the true lateral bands, chitinized, may be seen.

LIST OF HOSTS, WITH PARASITES.

- Larus glaucescens
  - Docophorus lari
- Larus sp.
  - Docophorus lari.
  - Nirmus punctatus.
  - Colpocephalum abbotti.
- Diomedea nigripes.
  - Lipeurus confidens.
    - densus.
  - Eurymetopus taurus.
- Pelecanus californicus.
  - Lipeurus forficulatus.
  - Menopon titan var. linearis.
- Fregata aquila.
  - Lipeurus graciilicornis, var. major.
  - Colpocephalum spineum.
  - Menopon auri-fasciatum.
- Merganser serrator.
  - Docophorus icterodes.
- Anas carolinensis.
  - Trinoton luridum.
- Ardea virescens.
  - Colpocephalum diffusum.
- Tringa macularia.
  - Docophorus cordiceps.
  - Nirmus furvus var. ravus.
- Tringa sp.
  - Nirmus fissus var. major.
- Lagopus lagopus.
  - Lipeurus protervus.
  - Goniodes mammillatus.
  - Menopon striatum.
- Polyborus cheriway.
  - Nirmus splendidus.
  - Colpocephalum maculatum.
- Falco sparverius peninsularis.
  - Nirmus fuscus.
- Crotophaga sulcirostris.
  - Lipeurus macgregori.
- Coccyzus americanus occidentalis.
  - Docophorus latifrons var. occidentalis.
- Piaya cayana thermophila.
  - Nirmus atopus.
  - Colpocephalum diffusum.
- Melanerpes wagleri.
  - Physostomum invadens.
- Melanerpes uropygialis.
  - Menopon præcursor.
- Melanerpes formicivorus angustifrons.
  - Docophorus californiensis.
- Myiarchus cinerascens nuttingi.
  - Docophorus rufus.
- Elainea subpagana.
  - Physostomum pallens.
  - Colpocephalum diffusum.
- Corvus corax sinuatus.
  - Colpocephalum subæquale.
- Amblycercus holosericeus.
  - Nirmus virgatus.
  - Colpocephalum diffusum.
- Arremonops striaticeps.
  - Colpocephalum diffusum.
- Saltator albicollis.
  - Colpocephalum diffusum.
- Chiroxiphia lanceolata.
  - Physostomum invadens.
  - Colpocephalum diffusum.
- Cardinalis cardinalis igneus.
  - Docophorus communis.
- Phœnicothraupis fuscicauda.
  - Docophorus panamensis.
  - Colpocephalum diffusum.
- Progne subis hesperus.
  - Docophorus domesticus.
- Phainopepla nitens.
  - Nirmus peninsularis.
- Protonotaria citrea.
  - Physostomum pallens.
- Dendroica bryanti.
  - Nirmus interpositus.
  - Colpocephalum diffusum.
- Cinclus mexicanus.
  - Docophorus laticeps var. americanus.
- Parus atri-capillus occidentalis.
  - Docophorus rutteri.
- Auriparus flaviceps.
  - Nirmus audax.

EXPLANATION OF PLATES.

PLATE I.—Fig. 1, *Docophorus panamensis* Kellogg, ♀. Fig. 2, *D. cordiceps* Giebel, ♂. Fig. 3, *D. rutteri* Kellogg, ♀. Fig. 4, *D. laticeps* G., var. *americanus* Kellogg, ♀. Fig. 5, *D. latifrons* N., var. *occidentalis* Kellogg, ♀. Fig. 6, *D. rufus* Kellogg, ♀. Fig. 7, *D. laticeps* G., outline of head. Fig. 8, *D. latifrons* N., var. *occidentalis* Kellogg, abdomen of ♂, ventral aspect. Fig. 9, *D. rufus* Kellogg, abdomen of ♀, ventral aspect.

PLATE II.—Fig. 1, *Nirmus furvus* N., var. *ravus* Kellogg, ♀. Fig. 2, *N. fissus* N., var. *major* Kellogg, ♀. Fig. 3, *N. splendidus* Kellogg, ♀. Fig. 4, *N. atopus* Kellogg, ♀. Fig. 5, *N. virgatus* Kellogg, ♀. Fig. 6, *N. splendidus* Kellogg, genital blotch of ♂. Fig. 7, *N. interpositus* Kellogg, ♀. Fig. 8, *N. audax* Kellogg, ♀. Fig. 9, *N. peninsularis* Kellogg, ♀.

PLATE III.—Fig. 1, *Lipeurus confidens* Kellogg, ♀. Fig. 2, *L. densus* Kellogg, head of ♂. Fig. 3, *L. gracilicornis* P., var. *major* Kellogg, ♂. Fig. 4, *L. protervus* Kellogg, ♀. Fig. 5, *L. macgregori* Kellogg, head of ♂. Fig. 6, *L. macgregori* Kellogg, ♀.

PLATE IV. Fig. 1, *Colpocephalum spineum* Kellogg, ♂. Fig. 2, *C. maculatum* P., ♂. Fig. 3, *C. diffusum* Kellogg, ♂. Fig. 4, *C. diffusum* Kellogg, ventral aspect of abdomen of ♀. Fig. 5, *Menopon auri-fasciatum* Kellogg, ♀. Fig. 6, *M. striatum* Kellogg, ♀. Fig. 7, *Physostomum pallens* Kellogg, ♀. Fig. 8, *Menopon præcursor* Kellogg, ♀. Fig. 9, *Colpocephalum abbotti* Kellogg, ♀.

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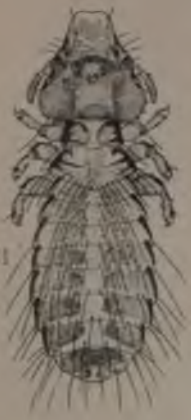

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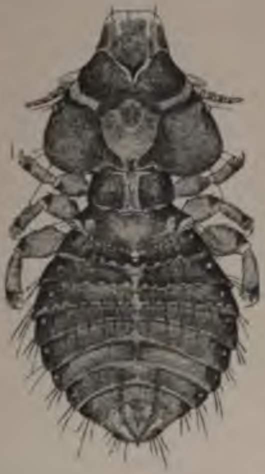

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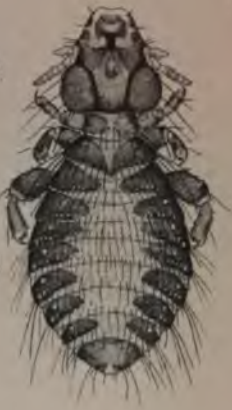

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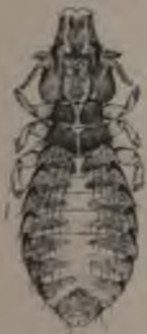

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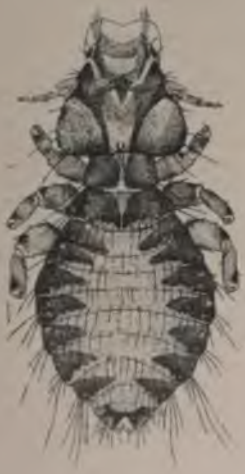

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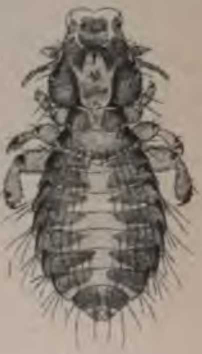

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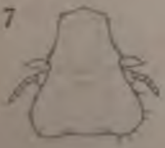

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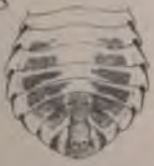

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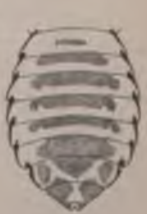

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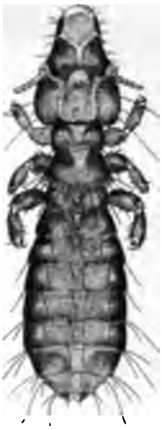

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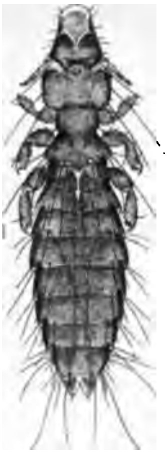

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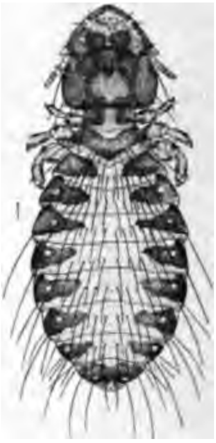

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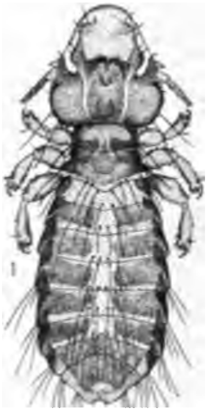

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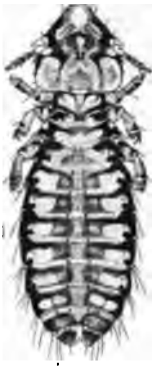

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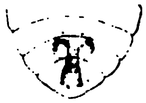

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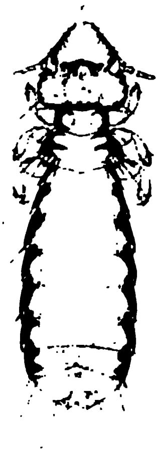

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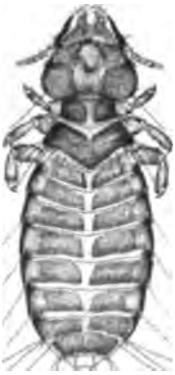

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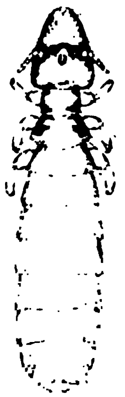

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[Kellogg] Plate III.

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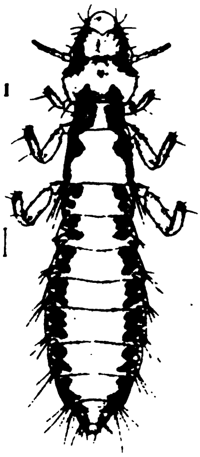

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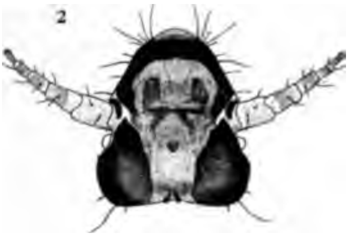

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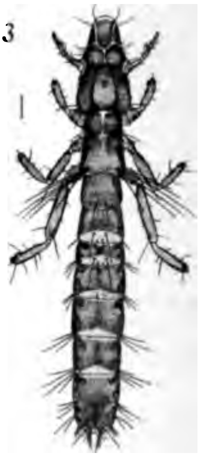

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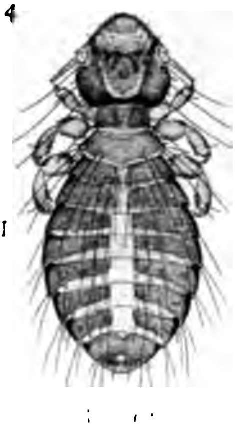

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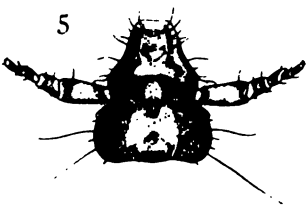

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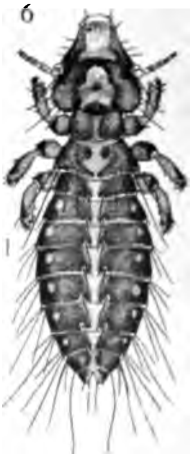

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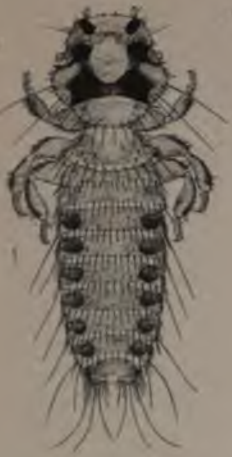

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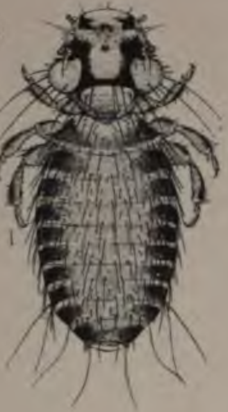

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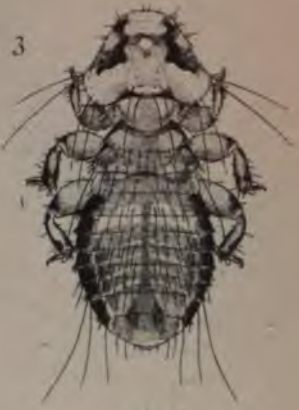

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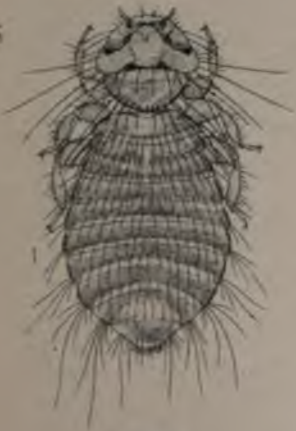

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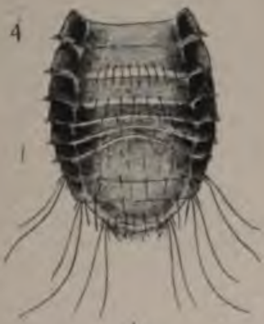

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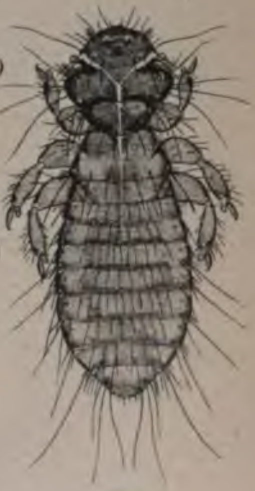

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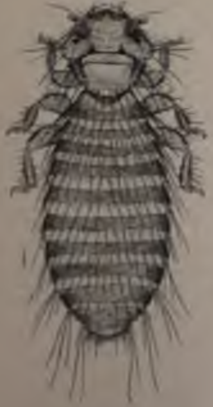

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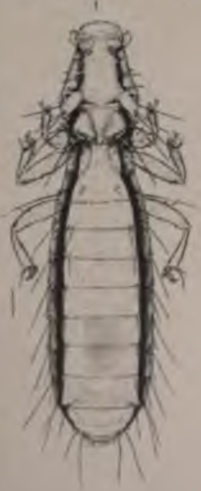

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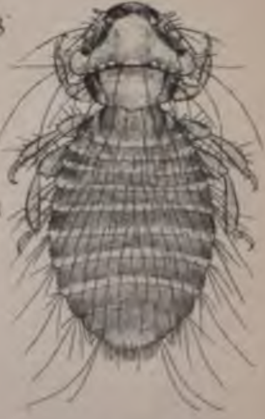

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MALLOPHAGA FROM BIRDS OF CALIFORNIA.

(With Plates V to IX.)

BY VERNON L. KELLOGG AND BERTHA L. CHAPMAN.

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- **Oncophorus.**
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- **Colpocephalum.**
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- **Menopon.**
- **Physostomum.**

List of Hosts, with Parasites.

INTRODUCTION.

The Mallophaga described and referred to in this paper were collected by Messrs. Snodgrass, Osgood, Brown, and McLain, students of Stanford University, California, Mr. Ed. M. Ehrhorn, Horticultural Commissioner for Santa Clara County, California, and by the senior author, Mr. Kellogg. All of the specimens from birds of the Bay of Monterey, California, were taken by Mr. Kellogg from just-killed birds or freshly made skins collected by Mr. Leverett M. Loomis, Curator of the Department of Ornithology, California Academy of Sciences. The authors desire to acknowledge their obligations to these various collectors.

The sequence of genera in this paper is that adopted in the European monographs and in the papers of the senior author (Kellogg, New Mallophaga I, 1896;* New Mallophaga II, 1896;* Mallophaga from Birds of

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* Proc. Cal. Acad. Sci., 2d. Ser. Vol. VI.

Panama, Baja California, and Alaska, in New Mallophaga III, 1899). The sequence of species in each genus is determined by the hosts, the sequence of hosts being that of the A. O. U. Check-List of North American Birds, 2d. edition, 1895.

Docophorus.

Docophorus procax n. sp. (Plate V, fig. 1).

Many specimens from two Pigeon Guillemots, *Cepphus columba* (Bay of Monterey, California). A member of the group *trianguliferi* Piaget (Les Pediculines, p. 113), and most resembling *pilosus* Piaget (ibid, p. 116, pl. x, fig. 4) from a flamingo, *Phœnicopterus antiquorum*, but differing in the hairs of clypeus, of metathorax, shape of abdominal blotches, etc.

Description of the male. Body, length 1.45 mm., width .76 mm.; head comparatively large, with frontal part of clypeus uncolored and expanded; thorax and first segment of abdomen golden brown with darker markings; abdomen oval, pale, whitish medially, with dark brown transverse bands and blackish lateral bands.

Head, length .52 mm., width .54 mm.; conical, temples wide, sides rapidly approaching each other anteriorly; frontal uncolored clypeal space expanded; front straight or feebly concave; no hairs on the rounding uncolored clypeal region but one short marginal prickle at the point where the clypeus begins to swell beyond the sides of the head; a second short prickle before the suture; two dorsal hairs just before the clear uncolored clypeal region; two short prickles in front of the trabeculæ; trabeculæ large, reaching nearly to the end of the second segment of the antennæ, well colored with pale brown, a short prickle at the base; antennæ small, of the same golden brown as the head, with slightly darker markings; eye inconspicuous, with two short prickles and an ocular fleck; temples rounded, with two long hairs and several prickles; occipital margin straight; clypeal signature broadly shield-shaped, sides constricted anteriorly, with posterior angle reaching almost to the mandibles; the quadrangular space in the middle of the signature is slightly darker than the most anterior portion; antennal bands interrupted by the suture, the bands turning in at the suture, nearly meeting on the median line, the bands themselves becoming narrow and acuminate; the posterior ends of the antennal bands bend in and back till they meet the dark blotch caused by the mandibles showing through the head; ocular blotches distinct; temporal borders narrow, occipital bands distinct, slightly diverging anteriorly; occipital border not extending to the sides of the head.

Prothorax broad, with sides diverging; posterior angles rounding; lateral borders dark, extending in along the posterior margin. Metathorax pentagonal, sides strongly divergent, posterior margin angular, with slightly rounding tip on the abdomen; one short prickle and one long pustulated hair in the posterior angles, three pustulated hairs each side of the posterior marginal angle; segment pale in the middle, growing darker laterally and posteriorly. Legs of the same golden brown as the thorax, darker lateral borders and annulations, claws also dark. Sternal markings consist of dark brown intercoxal lines and a pale median metathoracic blotch.

Abdomen broadly ovate, turbinated; segments 2 to 7 with prominent posterior angles, each bearing

from one to three long hairs; segment 1 wholly golden brown, the transverse blotches meeting near the posterior margin in an acute point; the transverse lateral blotches of segments 2 to 7 are separated by a transparent whitish median space; the lateral margins of the segments are dark brown to black; along the posterior margins of the transverse lateral bands are partially uncolored spots bearing long hairs; stigmatal spots distinct; segment 8 wholly pale brown, darker in the middle, owing to the dark genitalia showing through; segment 9 very small and uncolored; genitalia distinct, dark brown reaching as far forward as segment 6.

Female. Body, length 1.62 mm., width .78 mm.; head, length .56 mm., width .53 mm.; abdomen not so broad in comparison with the length as in the male, not turbinated, and the median whitish space larger.

Docophorus lari Denny. (See Kellogg, New Mallophaga, I, 1896, p. 98, pl. iv, fig. 4).

Specimens from *Larus delewarensis, L. occidentalis* (three birds), and *L. heermanni* (two birds) (Bay of Monterey, California). Previously taken by Kellogg from these and other species of *Larus.*

Docophorus melanocephalus Burmeister. (See Kellogg, New Mallophaga, I, 1896, p. 99, pl. iv, fig. 6).

Two specimens from the Royal Tern, *Sterna maxima* (Bay of Monterey, California), and two specimens from the Pomarine Jaeger, *Stercorarius pomarinus* (Bay of Monterey, California). Previously taken by Kellogg from *Sterna maxima* (same locality).

Docophorus validus n. sp. (Plate V, fig. 2).

A single female specimen of this striking *Docophorus* from a Black-vented Shearwater, *Puffinus opisthomelas*

(Bay of Monterey, California). In general shape and in certain special characters this new form somewhat resembles *D. brevi-antennatus* Piaget (Les Pediculines, p. 108, pl. ix, fig. 9) from *Sula australis* (Museum of Leyden); the differences, however, in shape of metathorax, abdominal blotches, etc., are marked.

Description of the female. Body, length 2.25 mm., width 1.18 mm.; large triangular head with narrow, emarginate front; abdomen nearly circular, with strongly marked, lateral, transverse blotches, mostly acute inwardly.

Head, length .72 mm., width .72 mm., front of the head before the trabeculæ elongate and markedly narrowing anteriorly; dark lateral margins extending slightly beyond the narrow, concave, uncolored clypeal region, terminating in a sharp, slightly incurving angle; a short prickle on the anterior margin of this projecting angle, a short hair on the lateral margin of the front, near the suture; two dorsal hairs extending beyond the lateral margin of the head; trabeculæ large, reaching to the end of the second segment of the antennæ; segment 1 of the antenna long, segment 5 but little longer than segments 3 or 4; eyes prominent, with a short spine and a hair; temples slightly protruding, parabolic, with two long hairs and three short spines; occipital margin slightly convex upon the prothorax; signature distinct, anteriorly concave; deeper chestnut-brown along the anterior margin than through the wide median portion, posteriorly narrowing into a dark, narrow, acuminate point reaching to the mandibles; the anterior portion of this posterior point is darker than the rest of the signature; antennal bands broad, even, of a dark, rich, golden brown, paling slightly in the anterior portion, beyond the suture; posterior extremities bending inwardly, separated by a pale median-space between the occipital bands; occipital bands much paler than the temporal borders, indistinctly fading anteriorly into dark ocular blotches; temporal margins narrowly bordered with dark brown; occipital blotches distinct.

Prothorax small, oblong; angles rounding, with one long hair; lateral blotches distinct, separated by a pale median line, darker along the posterior margin near the angle, and fading gradually anteriorly. Metathorax only two-thirds as wide as the head, with strongly diverging sides, rounding, posterior angles; posterior margin broadly rounded upon the abdomen; one very short prickle and one long hair in a pale brown space on the posterior angle; six long pustulated hairs on the posterior margin; lateral markings little darker than the general dark brown of the metathorax.

Abdomen nearly circular; transverse, lateral blotches distinct, acute inwardly, and darkest at the inner ends; each bearing from one to four pustulated hairs; segment 8 entirely dark brown; segment 9 rounding, with a narrow, angular emargination; one fine hair each side of this emargination.

Docophorus icterodes Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 96, pl. iv, fig. 1).

Specimens from a Lesser Scaup Duck, *Aythya affinis*, and from an American Scaup Duck, *Aythya marila nearctica* (Palo Alto, California). Previously taken by Kellogg from the first named host species, and from six other duck species.

Docophorus fusiformis Denny. (Plate V, fig. 3).

Monographia Anoplurorum Britanniæ, 1842, p. 84, pl. i, fig. 2.

Docophorus fusiformis D., Giebel, Insecta Epizoa, 1874, p. 104; Piaget, Les Pediculines, 1880, p. 86, pl. vi, fig. 7.

Docophorus fissiformis D., Osborn, Insects Affecting Domestic Animals, Bull. 5, N. S., Div. of Ent., U. S. Dept. Ag., 1896, p. 217.

One male from a Least Sandpiper, *Tringa minutilla* (Palo Alto, California). Denny's specimens were taken from the same host; Giebel's single specimen from the same host, and Piaget's from *Tringa subarquata*. Osborn's specimens are from the "black-billed sandpiper" (Burnett collection). Our specimen has no emargination of the clypeal front, a character especially noted by Denny and Piaget. But Giebel's specimen is like ours: "der Vorderrand ist nicht tief ausgeschnitten, sondern nur sanft concav." The species can be recognized by the large elongate head, the dark coloration, and narrow genitalia. Our specimen, figured, measures: body, length, 1.31 mm., width .5 mm.; head, length .5 mm., width .44 mm.

Docophorus fuliginosus Kellogg.

New Mallophaga, I, 1896, p. 80, pl. iii, fig. 2.

Specimens from the Black-bellied Plover, *Squatarola squatarola*, and from the Semipalmated Plover, *Ægialitis semipalmata* (Pacific Grove, California). Described from *Squatarola squatarola* (Kansas and California).

Docophorus pictus Giebel. (Plate V, fig. 4).

Insecta Epizoa, 1874, p. 74.

Docophorus pictus G., Piaget, Les Pediculines, 1880, p. 23.

Numerous specimens from a Golden Eagle, *Aquila chrysaëtos* (Palo Alto, California). The specimens are of the characteristic group infesting eagles, of which *platystomus* N. (Giebel, Insecta Epizoa, p. 69, pl. ix, fig. 1; Piaget, Les Pediculines, p. 17, pl. i, fig. 1) may be taken as type. So many species have been described in this group, on what seems to us slight differences, that one may well despair of making a satisfactory reference of his specimens to any one of the forms to the exclusion of all others. From this same host half a dozen species of *Docophorus* (all of the *platystomus* type) have been described.

The truncate, not emarginated, clypeal front, and the slight dilation of the uncolored part of the clypeus lead us to refer our specimens to a species proposed by Giebel for specimens collected from the same host as that of our specimens. Osborn (Insects Affecting Domestic Animals, 1896, p. 218,) describes a species *halieti* from the Bald Eagle, *Haliæetus leucocephalus* (Florida). This species has a marked lateral, anterior, clypeal dilation, and the front is emarginate.

The members of the group may be recognized by the uncolored front of the clypeus more or less dilated. We figure a female. Measurements: Male, body, length 2.22 mm., width 1.2 mm.; head, length .85 mm., width .91 mm. Female, body, length 2.81 mm., width 1.4 mm.; head, length .94 mm., width 1. mm.

Docophorus cursor Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 484, pl. lxvi, fig. 1).

Specimens from two individuals of the American Long-eared Owl, *Asio wilsonianus*, (Ontario, California). Taken previously by Kellogg from *Bubo virginianus* (Lawrence, Kansas). Recorded by Osborn from *Asio wilsonianus* (Ames, Iowa, and Lincoln, Nebraska).

Docophorus speotyti Osborn.

Insects Affecting Domestic Animals, 1896, Bull. No. 5, Div. o Ent., U. S. Dept. Ag., p. 222, fig. 144.

Specimens from a Spotted Owl, *Syrnium nebulosum* (La Honda, California). Agrees well with Osborn's description (except that the abdomen is narrow, with subparallel sides in the *female*, while it is more elliptical, widest at segment 4, in the *male*, just the reverse of the condition according to Osborn).

Docophorus ceblebrachys Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 485, pl. lxvi, fig 3).

Many specimens from a Snowy Owl, *Nyctea nyctea* (Pullman, Washington). Taken previously by Kellogg from same host (Kansas).

Docophorus singularis n. sp. (Plate V, fig. 5).

Specimens from a Nuttall's Woodpecker, *Dryobates nuttallii* (Ione, California). Not like any other woodpecker-infesting *Docophori*, but belongs rather to the group *femorati*.

Description of the female. Body, length 1.43 mm., width .71 mm.; dark chestnut-brown with distinct bands on the head and thorax, angular, lateral, transverse blotches on the abdomen; unique in the possession of bipartite trabeculæ.

Head, length .65 mm., width .53 mm.; large, broadly concave, uncolored clypeal region broad with straight to slightly concave front; one marginal hair in front of distinct suture, two dorsal hairs near the lateral margin, one rather short and stiff, extending forward beyond the clypeal margin, the second very long; two dorsal hairs in front of the trabeculæ; the trabeculæ divided, anterior part short and acutely angulated, extending around the base of the posterior portion of the trabeculæ on the ventral surface, the posterior portion of the trabeculæ nearly as long as the first two segments of the antennæ, about the same width throughout, a deep chestnut-brown at the base, with uncolored tip; antennæ with the first two joints long and about equal, pale golden brown, last three joints darker chestnut-brown, a few short spines on the joints, especially numerous and strong on the first two joints; eye with one long hair, and near the posterior margin a second long hair; temples rounding, with three long, pustulated; marginal hairs and one short prickle, occipital margin slightly convex; signature distinct, anterior margin concave, with a slight lateral constriction near the anterior angles, posterior angles extended backward, posterior margin extending in a long, acute angle beyond the mandibles; antennal bands distinctly interrupted at the suture, dark chestnut-brown, posterior extremities inward and back, meeting well defined, diverging occipital bands; temples dark chestnut-brown, with narrow blackish margins, interrupted by large pustulations.

Prothorax small, lateral margins strongly rounding; one long pustulated hair in the posterior angle; lateral blotches dark chestnut-brown, separated by a pale median line; blackish lateral borders. Metathorax with strongly divergent lateral margins nearly as wide as the head; a series of long pustulated hairs on the angulated posterior margin; lateral blotches dark, separated by a pale median line which widens distinctly near the middle; bands of blackish brown on the lateral and posterior margins. Sternal markings composed only of the distinct intercoxal lines between the pro- and mesothoracic legs. Legs pale brown with dark bands.

Abdomen broadly ovate, segments distinctly narrowing on the median line; one to three long hairs in the posterior angles; many long, pustulated, dorsal hairs in a transverse series on the posterior margin of each segment; lateral transverse triangular blotches dark chestnut-brown, slightly darker on the lateral margin; median portion of the abdomen uncolored; posterior margin of the transverse blotches interrupted by uncolored pustulations; segment 8 entirely dark brown;

segment 9 narrowly emarginate, rounding, with two short prickles on the posterior margin; two dark lateral blotches separated by a broad uncolored space; genital blotches distinctly dark brown, broadly rounding on segments 5 and 6, posterior margin rapidly tapering to segment 8.

Male same size as female; last segment broadly, flatly rounded, with several long hairs on each side of the bare median third of the posterior margin.

Docophorus californiensis Kellogg.

New Mallophaga, II, 1896, p. 483, pl. lxvi, fig. 6.

Specimens from Williamson's Woodpecker, *Sphyrapicus thyroideus* (El Dorado county, California), the White-headed Woodpecker, *Xenopicus albolarvatus* (El Dorado county, and Kings River Cañon, California), and the Californian Woodpecker, *Melanerpes formicivorus bairdi* (Palo Alto, California). Types collected by Kellogg from *Melanerpes formicivorus bairdi* (Palo Alto, California). The specimens from the El Dorado county birds show narrow heads and bodies, but this is probably due to shrinking in drying, as all the specimens of the small collections from this locality appear to have suffered in the same way.

Docophorus rufus Kellogg.

Mallophaga from Birds of Panama, Baja California and Alaska, in New Mallophaga, III, 1899, p. 7, pl. i, figs. 6 and 9.

Three specimens from an Ash-throated Flycatcher, *Myiarchus cinerascens* (Alameda county, California) and three specimens from another specimen of the same bird species from Ontario, California. Described by Kellogg from *Myiarchus cinerascens nuttingi* (Baja California).

Docophorus fusco-ventralis Osborn.

Insects Affecting Domestic Animals, 1896, Bull. 5, N. S., Div of Ent., U. S. Dept. of Ag., p. 221.

One specimen from an Ash-throated Flycatcher, *Myiarchus cinerascens* (Palo Alto, California). Osborn's specimens were from the Wood Pewee, *Contopus virens* (Cornell University Collection; Burnett Collection).

Agrees well with Osborn's description, except that the fuscous coloration of ventral aspect is in broad transverse bands separated by distinct, paler sutural bands, instead of being "beneath uniformly dark brown."

Docophorus communis. (See Kellogg, New Mallophaga, II, 1896, p. 486, pl. lxvi, fig. 7).

Under this name we group together a large number of very similar forms; or if dissimilar, forms connected by gradatory specimens. These forms are taken from passerine birds and belong to Piaget's group *femorati* (Les Pediculines, p. 53), characterized by the large truncate or feebly convex or weakly emarginated clypeus, with long hair in each anterior angle, by the especially large third pair of legs, and by the conspicuous pustulated hairs of the thorax and abdomen. The marked variation (notably in size of hindmost legs) among individuals from a single bird specimen (let alone bird species) and the series of gradatory forms connecting all the variations manifest in the group make it impossible for us to attempt to distinguish different species in this mass of material. Piaget has, indeed, attempted to define half a dozen varieties of *communis*, but in no very confident manner. The group *femorati* can furnish time-killing work for any student bold enough to undertake its discipline.

Docophori of this group, referable to the species *communis*, in its widest sense, have been determined by us from the following passerine hosts, all from California: Ash-throated Flycatcher, *Myiarchus cinerascens*; Western Flycatcher, *Empidonax difficilis*, two specimens; Mexican Horned Lark, *Otocoris alpestris chrysolæma*; Blue-fronted Jay, *Cyanocitta stelleri frontalis*, three specimens; California Jay, *Aphelocoma californica*; Western Meadow Lark, *Sturnella magna neglecta*; Brewer's Blackbird, *Scolecophagus cyanocephalus;* Pine Siskin, *Spinus pinus;* Western Lark Sparrow, *Chondestes grammacus strigatus*, two specimens; Intermediate Sparrow, *Zonotrichia leucophrys intermedia;* Gambel's Sparrow, *Zonotrichia leucophrys gambelii*, three specimens; Golden-crowned Sparrow, *Zonotrichia coronata*, two specimens; *Spizella* sp.; Western Chipping Sparrow, *Spizella socialis arizonæ;* Bell's Sparrow, *Amphispiza belli;* Samuel's Song Sparrow, *Melospiza fasciata samuelis*, two specimens; California Towhee, *Pipilo fuscus crissalis*, two specimens; Black-headed Grosbeak, *Zamelodia melanocephala;* Western Blue Grosbeak, *Guiraca cærulea eurhyncha*, three specimens; Louisiana Tanager, *Piranga ludoviciana*, two specimens; Cedar Waxwing, *Ampelis cedrorum;* Northern Shrike, *Lanius borealis;* California Shrike, *Lanius ludovicianus gambeli*, two specimens; Cassin's Vireo, *Vireo solitarius cassinii;* Yellow Warbler, *Dendroica æstiva*; Vigor's Wren, *Thryothorus bewickii spilurus;* Plain Titmouse, *Parus inornatus*, three specimens; Audubon's Hermit Thrush, *Turdus aonalaschkæ auduboni;* Western Bluebird, *Sialia mexicana occidentalis*. Previously taken by Kellogg from sixteen species of passerine birds.

Docophorus mirinotatus n. sp. (Plate V, fig. 6).

A female and several immature specimens from a Thurber's Junco, *Junco hyemalis thurberi* (Goat Mt., alt. 11,500 ft., Kings River Cañon, California). This Nirmoid form does not much resemble any other *Docophorus* known to us. The strangely emarginated, transverse abdominal blotches are unique.

Description of the female. Body, length 1.65 mm., width .53 mm., slender, Nirmoid in form, with head wider than thorax and almost as wide as abdomen; abdomen yellowish white, with narrow blackish lateral bands, and transverse bands with their anterior margins widely and irregularly emarginated.

Head, length .46 mm., width .43 mm.; clypeus broad, with straight or very slightly concave front; one short hair in the lateral margin near the front, a second longer hair in front of the suture; eye with a long hair; temples flatly rounding, with two very long hairs and two or three prickles; markings indistinct; antennal bands interrupted at the suture; occipital bands widely separated posteriorly but converging rapidly anteriorly, forming a triangle with the mandibles at apex; trabeculæ slender, short.

Prothorax narrow, quadrangular, with a long hair in the posterior angle; pale medially, with distinct dark lateral bands. Metathorax with a series of long hairs along the posterior margin which is distinctly angulated on the abdomen; lateral, dark brown borders.

Abdomen slender, elongate-elliptical; from one to three long hairs in the posterior angles of the segments and a dorsal, transverse series of long pustulated hairs on each segment rising near the middle of the segments; segments with median blotches which are widely and irregularly emarginate anteriorly, the blotches also interrupted by the pustulations which fade into the medial emargination; the transverse blotches distinctly darker on the posterior margin just beneath the uncolored medial space and extending laterally not quite to the lateral bands; distinct narrow blackish bands on the lateral margins; last segment narrowly, angularly emarginate, with a short hair on the posterior margin each side of the emargination, and with pale brown transverse blotches, but no dark bands on lateral margins.

Docophorus mirus n. sp. (Plate V, fig. 7).

A few specimens from two Vigor's Wrens, *Thryothorus bewickii spilurus* (Palo Alto, California). Characterized by the very large head and small abdomen, the head being two-fifths as long as the whole body and almost, if not quite, as wide.

Description of the female. Body, length 1.5 mm., width .65 mm.; head very large in proportion to the body, five-sixths as wide as the abdomen and two-thirds as long.

Head, length .56 mm., width .53 mm., broadly conical; uncolored clypeal front slightly concave in the middle, a rather long stiff dorsal hair rising near the lateral margin and extending forward beyond the margin of the head, a short hair on the margin in front of a distinct suture, two rather long hairs before the trabeculæ which reach as far as the end of the second segment of the antennæ; segment 2 of the antennæ long, segment 5 longer than either segment 3 or 4; eye distinct, a long hair on the dorsal surface and a shorter hair arising near the posterior angle; three long hairs and a short prickle on the rounding angle of the temples; occipital margin slightly convex; signature distinct, pale fulvous, anterior margin slightly concave; lateral margins straight, though the dark, narrow lines of the inner bands make it appear that there is a strong

constriction near the anterior margin; posterior angles rounding; posterior margin extending back beyond the mandibles in a dark, narrow point; antennal bands marginal, narrow, dark chestnut-brown, interrupted by the distinct suture, bending in to meet the anterior ends of the occipital bands in an indefinite, pale fulvous band; temples bordered anteriorly with a narrow border of dark chestnut; occipital bands narrow but distinct posteriorly, widely diverging and apparently connecting with the antennal bands.

Prothorax narrow, about half as wide as the head; lateral margin convex, one long pustulated hair in the posterior angles; a narrow lateral border of dark chestnut-brown. Metathorax with sides convex and strongly diverging; a series of long pustulated hairs on the posterior margin which is obtusely angled on the abdomen; lateral margin bordered with dark chestnut-brown. Legs fuscous, with dark fuscous borders and semiannulations; third pair of legs conspicuously large; a few scattered hairs and spines.

Abdomen broadly ovoid, short in comparison with the large head; first three segments longer than the others, their posterior margins more nearly straight; segments 4 to 8 narrowed, especially in the middle; last segment narrowly emarginate; many long pustulated hairs on the abdomen arranged in series on the posterior margin of each segment, especially thick along the middle; three or four short prickles on the lateral margin of the emargination of the last segment; first four segments dark chestnut-brown, segments 5 to 9 paler fuscous.

Male. Body, length 1.46 mm., width .53 mm.; head, length .53 mm., width .5 mm.; last abdominal segment rounded, with a fringe of about ten rather long weak hairs.

Nirmus.

Nirmus fusco-marginatus Denny. (Plate V, fig. 9).

Monograph. Anoplur. Brit., 1842, p. 136, pl. x, fig. 1.

Nirmus fusco-marginatus D., Giebel, Insecta Epizoa, 1874, p. 178; Piaget, Les Pediculines, 1880, p. 202, pl. xvi, fig. 6.

Many specimens of a *Nirmus* which may be referred to as a variety of this species of Denny, from an American Eared Grebe, *Colymbus nigricollis californicus;* also two specimens (rather smaller) from two Pigeon Guillemots, *Cepphus columba*, and a single specimen from the American Herring Gull, *Larus argentatus smithsonianus* (all the birds from the Bay of Monterey, California). Denny's types were taken from *Podiceps auritus* (Ireland), and Piaget's specimens from *Podiceps cristatus.* It seems to me that the *Nirmus podicipis* of Denny (Monograph. Anoplur. Brit. p. 142, pl. x, fig. 9) and the *Lipeurus runcinatus* Nitzsch (Giebel, Insecta Epizoa, p. 238) are both referable to *fusco-marginatus.* The antennal characters seem to be the same. As Piaget notes, the differing in the antennæ of male and female makes it difficult to refer the species to *Nirmus.* It is a form showing a transition to *Lipeurus.* Our specimens are one-fourth larger than the types of the species and differ in some minor particulars.

Var. *americanus* Kellogg and Chapman. (Plate V, fig. 9). Female, body, length 2.62 mm., width .81 mm.; head, length .56 mm., width .44 mm. Differs from the species type in having a spine in the posterior angles of the prothorax, and a hair on each lateral half of the posterior margin; the metathorax has six hairs and a spine on each lateral half of the posterior margin. The species is easily recognizable by its long slender body, short, narrow, pointed head, and the black, lateral, triangular, abdominal blotches with brown inward-projecting processes.

Nirmus pacificus n. sp. (Plate V, fig. 8).

Two males from a Tufted Puffin, *Lunda cirrhata;* one male from a Black-bodied Shearwater, *Puffinus griseus;* and specimens, males and females, from two Pigeon Guillemots, *Cepphus columba*—all the birds from the Bay of Monterey, California. The specimen from *Puffinus* is almost certainly a straggler, as no other specimen was taken from the fifty-five individuals of P *us* examined. The new species belongs to Pia- t's group *zonati* (Les Pediculines, p. 187), and is ost like *citrinus* (ibid. p. 190, pl. xvi, fig. 8). The n athorax, however, is angulated, not flatly rounded, as with *citrinus*, on the abdomen, and there are other differences.

Description of the male. Body, length 1.46 mm., width .5 mm.; short, broad, Docophoroid in form; light golden brown with conspicuous broad, dark antennal bands and dark brown to black lateral abdominal bands interrupted segmentally.

Head, length .5 mm., width .4 mm.; broadly conical; clypeal front very slightly concave; three marginal hairs on the front, one on the clear portion, and two before the suture; a short marginal prickle in front of the trabeculæ, one dorsal hair just back of the first marginal, a second dorsal hair near the second marginal, two dorsal hairs between the suture and the trabeculæ which are distinct and slightly colored; the antennæ are short, segments 2 and 5 being longer than the others; color, the light golden brown of the head marked with slightly darker brown; eyes inconspicuous, with two short prickles; temples with sides nearly straight, rounding on posterior angles, with one very long hair, one shorter, weaker hair, and two short prickles; occipital margin concave; clypeus with a pale but distinct pentagonal signature; antennal bands broad and dark, continuing beyond the suture; behind the obtuse posterior angle of the signature a narrow longitudinal uncolored space extending to the mandibles; temples bordered by a very narrow line of dark brown slightly broader just below the eye; a distinct though pale occipital signature.

Prothorax quadrangular, very short, broadly rounded, angles with one rather long hair; pale medially with dark brown lateral margins that bend in along the posterior margin. Metathorax pentagonal with widely diverging sides; posterior angles acute; six hairs in the angle and along the posterior margin; the posterior margin with a distinct elongate angle on the abdomen; dark lateral markings broadest on the posterior angles. Legs pale golden brown with slightly darker marginal markings.

Abdomen slightly elongate-oval, turbinate; posterior margins of segments 1–3 angulated, and anterior margins of segments 6–9 more obtusely angled; lateral angles of segments with one to three hairs; a few hairs on dorsal surface arranged along the posterior margins of the segments; posterior margin of segment 9 broadly rounded, with ten rather long hairs, several shorter hairs on dorsal surface of segment; color of abdomen fuscous; segment 1 without distinct lateral blotches, but segments 2–7 with dark brown to black lateral blotches, darkest in anterior angles and extending along the anterior margin of each segment almost to the median line; segment 8 but little darker in anterior angle, and segment 9 of an even pale fuscous; genitalia distinctly showing through, extending to segment 6.

Female, body, length 1.75 mm., width .6 mm.; head, length .55 mm., width .47 mm.; lateral abdominal bands distinct, blackish, the posterior part of each segmental portion tapering acuminately; segment 8 without lateral bands; segment 9 widely, angularly emarginate behind, with a single very fine short hair on each obtuse posterior point.

Nirmus maritimus n. sp. (Plate VI, fig. 1.)

Many specimens from numerous individuals of the Ancient Murrelet, *Synthliboramphus antiquus*, Cassin's Auklet, *Ptychoramphus aleuticus*, Rhinoceros Auklet, *Cerorhinca monocerata*. Also a single specimen (straggler) from a Pacific Fulmar, *Fulmarus glacialis glupischa*. All of these birds from the Bay of Monterey, California. Resembling *N. citrinus* Nitzsch (Giebel, Insecta Epizoa, p. 177; Piaget, Les Pediculines, p. 190, pl. xvi, fig. 8) from *Alca torda*, but more slender, with elongate head, angulated posterior margin of metathorax, different disposition of hairs of the head, etc.

Description of the female. Body, length 1.96 mm., width .46 mm.; slender, elongate; pale fuscous with darker lateral borders on the head and thorax and broad lateral bands on the abdomen.

Head, length .5 mm., width .37 mm.; narrowly elongate, conical, with clypeal front convex; three marginal hairs, the first one near the front and the third in front of the suture, the second is midway between these; a short prickle in front of the trabeculæ which reach to the end of the first segment of the antennæ; antennæ short, not reaching more than two-thirds of the distance to the occipital margin; segment 2 longer than segment 1, and segment 5 longer than segments 3 or 4; a few short hairs on the segment; eye with a hair and a short prickle; temples with sides nearly parallel; one long hair, one short hair, and three short prickles on the margin; occipital margin slightly concave; signature distinct, shield-shaped, anterior margin convex, posterior margin produced in a narrow point; antennal bands broad, interrupted by a distinct uncolored suture; the anterior extremities of the antennal bands bend broadly in at the suture, being separated medially by a narrow uncolored line that reaches nearly if not quite to the mandibles; ocular blotch fading inwardly; temporal borders narrow but well defined, broader just below the eye, gradually narrowing till it disappears before the occipital angle; a distinct conical occipital signature showing through from the under side of the head.

Prothorax with sides slightly diverging; posterior angles rounding, with one short hair; marginal borders dark golden brown, darker on the inner margin of the border; interrupted on the posterior margin by a broad pale median line. Metathorax with broadly rounding sides, diverging posteriorly; three hairs in the posterior angles; one long and one short hair on the posterior margin each side of the long, acute, median angle; lateral margins bordered with dark golden brown, darker on the inner margin. Legs pale fuscous with narrow dark marginal bands. Sternal markings consisting of pale fuscous intercoxal markings and a distinct median sternal blotch.

Abdomen narrow, elliptical; sides of the middle segments parallel; posterior angles with from one to two hairs; four dorsal hairs on the posterior margins of the segments, two near the middle and one each side near the lateral margin; transverse bands fuscous; lateral bands deep golden brown, broader anteriorly and extending beyond the suture into the segment in front; segments 2–6 with a pale posterior border; segments

7 and 8 w h pale longitudinal median band; last segment narrowly rounding, with a narrow emargination; one short hair on the posterior margin, each side of the emargination; ventral surface with broad transverse median blotches.

Male. Body, length 1.5 mm., width .4 mm.; head, length .46 mm., width .34 mm.; distinctly shorter than the female; abdomen more broadly elliptical; segments 7 and 8 narrowed distinctly in the middle; last segment adly rounded, with ten long hairs on the posterior rgin; transverse bands distinctly dark on segments 1 6; last segment evenly pale yellow; genitalia d wn, extending anteriorly to segment 5.

s Nitzsch. (Plate VI, fig. 2).

ges. Naturwiss. (Giebel), 1866, vol. xxviii, p. 378.

Nirm *mifer* Grube, v. Middendorff's Sibir. Reise, 1851, Zool. i, p. 478, pl. i, fig. 8.

Nirmus triangulatus **N., Giebel, Insecta Epizoa, 1874, p. 177; Piaget, Les Pediculines, 1880, p. 201, pl. xvi, fig. 5.**

Many specimens of this striking *Nirmus* from one out of two birds shot of the Pomarine Jaeger, *Stercorarius pomarinus* (Bay of Monterey, California). Our specimens differ from Piaget's figure in having the head distinctly shorter and narrower in front, giving the insect an appearance markedly different from the effect given by the figure. There is probably no doubt, however, regarding the identity of the species.

Nitzsch's specimens were taken from "*Lestris crepidata,*" Grube's from "*Lestris richardsoni,*" and Piaget's from *Stercorarius pomarinus* and *Larus canus* (Zool. Garden of Rotterdam).

The species may be readily recognized by the characteristic black, subtriangular, lateral, abdominal blotches, and the chestnut-brown, median, abdominal blotches (see figure). My specimens measured: Male, body, length 1.8 mm., width .62 mm.; head, length .53 mm., width .53 mm. Female, body, length 2.1 mm., width .63 mm.; head, length .6 mm., width .6 mm.

Nirmus lineolatus var. **atri-marginatus.** Kellogg and Chapman (For *lineolatus* see Kellogg, New Mallophaga, I, 1896, p. 113, pl. vi, figs. 7, 8 and 9).

Many specimens from *Larus canus*, *vegæ*, *brachyrhynchus* and *Rissa tridactyla pollicaris* (Bay of Monterey, California). A readily recognized variety of *lineolatus*, characterized by the presence of black temporal borders, usually strongly marked, sometimes weakly so. Other characters those of *lineolatus*.

Nirmus punctatus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 109, pl. vi, figs. 1 and 2).

Specimens from *Larus delewarensis* (Bay of Monterey, California). Taken previously by Kellogg from *Larus occidentalis* (same locality).

Nirmus giganticola Kellogg.

New Maliophaga, I, 1896, p. 105, pl. v, fig. 6.

Many specimens from a Short-tailed Albatross, *Diomedea albatrus*, and a single specimen from a Dark-bodied Shearwater, *Puffinus griseus* (Bay of Monterey, California). Described from *Diomedea albatrus* (same locality).

Nirmus complexivus n. sp. (Plate VI, fig. 3).

Many taken from the Sanderling, *Calidris arenaria* (Pacific Grove, California); found on every one of fifteen birds shot, and two specimens from a Least Sandpiper, *Tringa minutilla* (Palo Alto, California). This form belongs to the group *zonati*, of Piaget (Les Pediculines p. 187) and shows but slight differences from several of the species of this group already described, one or two from the same host, indeed; but on the other hand Nitzsch's and Piaget's species differ among themselves but little, and the American specimens differ quite as much from any described species. In fact they are interesting as showing a combination of several characters which are presented as diagnostic of *cingulatus* (the interrupted first abdominal band), *zonarius* (the hairs and spines of the temples, and the head longer than wide), and *scalaris* (the size). In addition they present characters (metathoracic hairs, *et al.*) which are not shown by any one of the described species. I describe the American form therefore as a new species. The group needs revision; probably four or five of the present species should be reduced to varieties of the oldest named form, i. e. *cingulatus*.

Description of the female. Body, length 1.71 mm., width .5 mm.; readily distinguishable by its general dark color, and rounding, uncolored clypeus with the distinct colored signature, on each side of which lie the narrow triangular projections of the anterior ends of the antennal bands; the posterior ends of the antennal bands bend so strongly in at the suture that they mark the fore part of the head off from the hind part into a small cone.

Head, length .4 mm., width .34 mm.; elongate, triangular, with clypeus broadly rounding, the uncolored region slightly expanded beyond the suture; two short hairs on the rounding margin of the uncolored clypeus, one rather long hair in front of the trabeculæ; trabeculæ prominent, angular, reaching beyond the first joint of the antennæ; antennæ short, reaching barely two-thirds of the distance to the occipital margin, pale fulvous with darker, broad annulations; segment 5 half as long again as segments 3 or 4; eyes distinct, with a hair and an ocular fleck; temples broadly rounding, with three long pustulated hairs, one short hair, and one prickle on the margin; occipital margin straight; clypeal signature constricted anteriorly, with the posterior, lateral angles projecting slightly backward; the posterior angle extending back indistinctly to the mandibles; antennal bands conspicuous, blackish brown, extending into long, paler, triangular projections on the clypeus; the blackish posterior ends extending in, meeting on the median line; ocular blotches contiguous with the dark temporal borders; occipital bands very definite, looking like two dark bars, bending outwards towards the ocular blotch but fading into the dark chestnut-brown of the temples; occipital blotch distinct; a pale transverse space behind the bent antennal bands, running like a curving bar across the head from margin to margin; occipital signature dark fuscous, spear-head-shaped.

Prothorax short, sides rounding; lateral quadrangular blotches separated by a narrow uncolored median line; lateral margin distinctly bordered with dark brown. Metathorax with strongly rounding sides; a short prickle in the anterior angle, a short prickle and a long pustulated hair near the middle of the lateral margin, two long pustulated hairs and two shorter hairs in the posterior angles, two short hairs on the posterior margin; the posterior margin rounding slightly upon the abdomen; strong, dark lateral bands. Legs light fulvous with dark marginal bands. Sternal markings consisting of intercoxal lines extending backward to the tip of the coxa of the second pair of legs;

a median sternal blotch rounding posteriorly with a sharp constriction about midway to the arrow-headed anterior portion.

Abdomen elongate, with one or two slender hairs in the posterior angles of the segments, two strong, pustulated hairs in the posterior margins of the segments; abdomen dark fulvous brown with broad, ill-defined, darker lateral bands, and a transverse linear band along the posterior margin of each segment of a darker brown, adjacent to which are the small uncolored stigmatal spots; the uncolored sutural lines distinct; segment 1 has the transverse band divided by a narrow uncolored median line; segments 8 and 9 more evenly colored; last segment angularly emarginated, with two anal blotches; two short hairs on the posterior margin each side of the emargination.

Nirmus actophilus n. sp. (Plate VI, fig. 4).

Many specimens from nine out of fifteen individuals shot of the Sanderling, *Calidris arenaria* (Bay of Monterey, California). A member of Piaget's group *obscuro-suturati* (Les Pediculines, p. 169) and resembling somewhat *inæqualis* (ibid., p. 176, pl. xv, fig. 1) from *Numenius arquata.*

Description of the female. Body, length 1.59 mm., width .4 mm.; pale, with distinct, narrow, lateral bands of dark brown to black, head darker brown than the thorax, with dark narrow marginal markings.

Head, length .37 mm., width .28 mm.; conical, but little wider through the temples; clypeus broadly rounded, with four marginal hairs, three on the front before the suture, and one long one before the trabeculæ, also a short prickle just at the angle of the trabeculæ; a dorsal hair between the two anterior marginal hairs, two other dorsal hairs on each side near the anterior extremity of the incurving antennal bands; trabeculæ distinct, reaching nearly to the end of the first segment of the antennæ; antennæ with segment 2 longer than segment 1, and segment 5 longer than segments 3 or 4; color pale fulvous, slightly darker on the last three segments, sutures uncolored, lateral margins slightly darker fuscous; eyes not conspicuous, flattened, with a fine hair and a short prickle; temporal margins slightly rounded, with one long weak hair, one very short hair, and three short prickles; occipital margin concave; clypeal markings distinct, marginal; signature short, distinct anterior margin fading into a broadly rounded posterior angle; behind the signature a transverse linear uncolored space, continuous with the clypeal sutures, forming a distinct uncolored transverse bar across the forehead; antennal bands well defined, bending forward at the clypeal suture into broad, quadrangular ends, posterior extremites bending backward nearly to the distinct ocular blotches, which meet posteriorly the anterior ends of the narrow black temporal borders; occipital blotches small; a distinct, elongate, oval, occipital signature showing through from the ventral side; the mandibles distinctly showing through the head, the œsophageal sclerite showing faintly.

Prothorax with flatly rounded lateral margins, each posterior angle with one pustulated hair; general color pale brown to whitish, with narrow dark lateral bands. Metathorax expanded posteriorly, angles extended, with three long pustulated hairs, and some short weak hairs in the angle and along the lateral third of the posterior margin; posterior margin slightly angulated on the abdomen; narrow black submarginal markings, broadening but less definite on the anterior angles; intercoxal

lines, and a narrow, lanceolate, median, sternal blotch showing through. Legs of an even fuscous, first pair lighter than the second or third pair.

Abdomen elongate, slightly attenuated anteriorly; segments 8 and 9 tapering rapidly; posterior angles acute, each containing from one to three hairs; dorsal surface with a few hairs, four on the posterior margins of segments 1 to 7, two near the middle and two near the lateral margins; ground color pale fawn, gradually growing darker posteriorly, with dark brown lateral bands which send out from their anterior half an indefinite line that partially surrounds the stigmatal spot; segment 9 angularly emarginate, each broadly rounded angle bearing a short bristle; ventral surface with broad transverse bands of dark fawn, which give a darker tone to the paler transverse bands of the dorsal surface; a more definite series of hairs on the posterior margin of the segments than above; segment 8 with a group of three short hairs near the lateral margin.

Nirmus cordatus Osborn.

Insects Affecting Domestic Animals, Bull. 5, N. S., Div. of Ent., U. S. Dept. Ag., 1896, p. 228, pl. ii, fig. *a*.

One female specimen from a Great Marbled Godwit, *Limosa fedoa* (Pacific Grove, California). We had determined this to be an undescribed form, and had partially written a description when Professor Osborn's paper appeared, naming and describing the species from a single female and an immature specimen from the Hudsonian Godwit, *Limosa hæmastica* (Burnett Collection, locality?). Our specimen agrees well with Osborn's description, except that it is somewhat larger, being 2.75 mm., long (Osborn's type 2.44 mm.), and 1.2

mm. wide, (Osborn's type .94 mm.); head, length .7 mm., (Osborn, .66 mm.), width .85 mm., (Osborn, .73 mm.) Osborn's figure, after a photograph, shows the characteristic outline, but we think there is also needed a figure showing the markings which are also very characteristic. The broad rounding anterior emarginations of first two transverse abdominal bands differ notably from the not uncommon narrow angular emarginations of these bands.

Nirmus incœnis n. sp. (Plate VI, fig. 5).

A single female from a Black-bellied Plover, *Squatarola squatarola* (Pacific Grove, California). Distinctly different from Kellogg's *orarius* (New Mallophaga I, 1896, p. 104, pl. v, fig. 5) from *Charadrius dominicus* (Lawrence, Kansas) or *bœphilus* (ibid, p. 107, pl. v, fig. 7) from *Ægialitis vocifera* (Lawrence, Kansas).

Description of the female. Body, length 1.65 mm., width .31 mm.; strikingly elongate, narrow; head long, with subparallel sides; pale golden brown with very narrow blackish lateral borders on the head, thorax, and abdomen; an ill-defined brownish band across the head in front of the antennal bands.

Head, length .37 mm., width .21 mm.; clypeal front broadly rounding, with three marginal hairs about equally distant apart, the third just before the suture, one hair arising from the dorsal surface, extending beyond the lateral margin of the head, a short fine hair in front of the small acuminate trabeculæ, antennæ short, segment 2 longer than segment 1, and segment 5 longer than segments 3 or 4; eye flat, with a prickle near its posterior angle; temples with sides parallel, with one long hair, one short fine hair, and one short prickle on the margin; occipital margin straight and bare; general color of the head golden brown, a narrow, irregular, marginal border on the clypeal front, darker on the inner margin; a weak brown band across the head in front of the antennal bands, which are narrow and distinctly dark golden brown; small ocular blotches and temples with very narrow dark brown borders.

Prothorax quadrangular, with rounding, posterior angles, each with one hair; transverse blotches golden brown, darker on the lateral margins and in the anterior and posterior angles; a broad, pale, median line separating the transverse blotches. Metathorax more than twice as long as the prothorax, and as wide as the head; sides diverging but little; a slight constriction near the anterior angles; a series of hairs on the rounding posterior margin; same golden brown as the prothorax, a narrow marginal border and a small brown spot in the anterior angles, a narrow but well defined border on the posterior half of the metathorax, the anterior ends bending in, making the slight constriction appear more than it really is. Legs paler golden brown than the thorax, with very narrow marginal borders of dark brown.

Abdomen narrow, elongate, with parallel sides, not tapering till segment 7; segment 1 narrower and shorter than those that follow; posterior angles but little extended, with one or two fine hairs; four long pustulated hairs on the posterior margins of the segments; transverse bands on segments 2 to 8 are golden brown, darkening towards the lateral margins where the lateral band is dark, narrow, and clearly defined; segments 7 to 9 without lateral bands; a pale transverse median band, caused by the uncolored stigmatal spots, thus the transverse blotches appear like two dark bands across each segment; segment 9 narrowly emarginate, with two pale brown blotches.

Nirmus opacus n. sp. (Plate VI, fig. 6).

Several specimens from two individuals of the Semipalmated Plover, *Ægialitis semipalmata* (Pacific Grove, California). The new species belongs to the group *bicuspidati* (Piaget, Les Pediculines, p. 184), being in size, outline and marking much like *bicuspis* N. (Giebel, Insecta Epizoa, p. 155, pl. v, figs. 11 and 12; Piaget, Les Pediculines, p. 184, pl. xv, fig. 7) from "*Charadrius minor*," *C. hiaticula* and *Recurvirostra avocetta*.

Description of the male. Body, length 1.11 mm., width .47 mm.; body dark colored all over, with narrow black lateral abdominal bands.

Head, length .4 mm., width .31 mm.; elongate-conical, with broad, rounding front; uncolored clypeal region slightly expanded in front of the suture; five marginal hairs, one in the rounding anterior angle, one just behind this, one at the suture, and two before the trabeculæ; a few dorsal hairs project beyond the margin; trabeculæ distinct, rather slender, acute, prominent for *Nirmus;* antennæ short, not reaching the occipital margin when projected backward, segment 2 longest, segments 3 and 4 short, subequal, segment 5 longer, concolorous with ground color of the head; eyes flat, with a long hair and a fine prickle; temporal margins flatly rounding, with two long hairs and two prickles; occipital margin straight; front of clypeus uncolored; signature large, colored, shield-shaped, from its posterior point a narrow uncolored line runs backward to the mandibles or beyond; antennal bands distinct, blackish brown, interrupted at suture, the part behind the suture curving, with anterior extremity expanded; hind head separated from fore head by an angulated, rather broad pale transveral space; temples unevenly bordered with blackish brown.

Prothorax quadrangular, with posterior angles nearly rectangular, with one long hair; brown with blackish, even, lateral borders. Metathorax pentagonal, angulated on abdomen; lateral angles with one short hair and three long pustulated hairs, and two long pustulated and one short pustulated on each postero-lateral margin; brown, darker in anterior angles. Legs concolorous with palest color of the thorax, and with narrow dark dorsal margining. Sternal markings composed of distinct intercoxal lines, a linear median blotch on prothorax and a more distinct, larger median blotch on metathorax.

Abdomen elongate-elliptical; posterior angles of segments projecting slightly, with three or four longish hairs beginning with segment 3; dorsal hairs of segment 1 arranged as follows: two on each side of the median line (one in the inner anterior and one in the inner posterior angle of each lateral blotch); segment 2 with four pustulated hairs along the posterior margin; segments 3 and 4 with six pustulated hairs on posterior margin; segments 5 and 6 with two pustulated hairs near the middle of the posterior margin, and a very long hair on the posterior margin near the posterior angles; segment 8 with six pustulated hairs along the posterior margin; segment 9 with eight dorsal hairs and four long marginal hairs; dark brown, with distinct narrow black lateral bands; a narrow uncolored median line reaching nearly to posterior margin of segment 2; the dark brown transverse blotches on segments 6–8 broadly emarginated posteriorly; segment 9 with elongate-elliptical transverse lateral blotches meeting on the median line (there are four pustulated hairs on each blotch); genitalia distinct, extending to posterior margin of segment 4.

Female. Body, length 1.75 mm., width .45 mm.; head, length .47 mm., width .28 mm. Metathorax with but two pustulated hairs on each postero-lateral margin; the narrow uncolored median line extends entirely through segment 2, and slightly into segment 3; segments 3–6 with four pustulated hairs on posterior margin, segment 7 with two median pustulated hairs on posterior margin, and segment 8 with two pustulated hairs in the rounding posterior angles; segment 9 deeply, angularly emarginated, the acute joints with a short prickle.

Nirmus fuscus Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 499, pl. lxvii, fig. 7).

Specimens from the Western Goshawk, *Accipiter atricapillus striatulus* (Pullman, Washington), the Desert Sparrow Hawk, *Falco sparverius deserticolus* (Palo Alto, California), the Western Red-tailed Hawk, *Buteo borealis calurus* (Palo Alto, California), and the White-tailed Kite, *Elanus leucurus* (Palo Alto, California). Taken previously by Kellogg from *Buteo swainsoni*, *Circus hudsonius* and *Archibuteo lagopus sancti-johannis*, all from Lawrence, Kansas. Recorded by Osborn from *Buteo swainsoni* (Ames, Iowa), and from *Accipiter velox* (locality ?).

These specimens combine characters of *fuscus*, *rufus*, *et al.* of Nitzsch, so as to lead us to doubt the distinctness of these various species of Nitzsch. We have with *Nirmus fuscus*, *sens latus*, of the hawks, a repetition of the condition shown by *Docophorus communis* of the passerine birds.

Nirmus vulgatus Kellogg.

New Mallophaga, II, 1896, p. 496, pl. lxvii, fig. 5.

Many specimens from numerous species of passerine birds. This *Nirmus* must be treated like *Docophorus communis*, in that we must group together under one specific name forms rather variant (notably in length and intensity of coloration), without being able as yet to distinguish categorically these variations. Osborn's *pallidus* (Insects Affecting Domestic Animals, 1896, Bull. 5, N. S., Div. of Ent., U. S. Dept. Ag., p. 227). from *Zamelodia ludoviciana* (Ames, Iowa) is probably based on palely colored specimens of this species. The name *N. pallidus*, by the way, is preoccupied (see Piaget, Les Pediculines, 1880, p. 144).

We refer to this species specimens from the Western Blue Grosbeak, *Guiraca cærulea eurhyncha* (4 birds, California); the Western Lark Sparrow, *Chondestes grammacus strigatus* (Ontario, California); the House Finch, *Carpodacus mexicanus frontalis* (Ontario, California); the California Towhee, *Pipilo fuscus crissalis* (2 birds, Palo Alto, California); the Spurred Towhee, *Pipilo maculatus megalonyx* (Palo Alto, California); the Golden-crowned Sparrow, *Zonotrichia coronata* (Palo, Alto, California); the Lazuli Bunting, *Passerina amœna* (Palo Alto, California); the Mountain Chickadee, *Parus gambeli* (El Dorado county, California); the Californian Chickadee, *Parus rufescens neglectus* (Palo Alto, California); the Western Bluebird, *Sialia mexicana occidentalis* (Palo Alto, California); the Yellow Warbler, *Dendroica æstiva* (Palo Alto, California); the Lutescent Warbler, *Helminthophila celata lutescens* (Palo Alto, California); the Black-chinned Hummingbird, *Trochilus alexandri* (Ontario, California); the Blue-fronted Jay, *Cyanocitta stelleri frontalis* (King's River

Cañon, California); the American Dipper, *Cinclus mexicanus* (Ontario, California); the Western Flycatcher, *Empidonax difficilis* (2 birds, Ontario, California), and the Ash-throated Flycatcher, *Myiarchus cinerascens* (Ontario, California). The specimens from the two last-named bird species, Flycatchers, show a common variation from the type specimens in a greater length, less angulated posterior margin of metathorax, and paler markings. Taken previously by Kellogg from eight species of passerine birds.

Nirmus fœdus n. sp. (Plate VI, fig. 7).

Specimens from the Ash-throated Flycatcher, *Myiarchus cinerascens* (Ontario, California), the Long-tailed Chat, *Icteria virens longicauda* (Ontario, California), Say's Phœbe, *Sayornis saya* (Ontario, California), the Arkansas King-bird, *Tyrannus verticalis* (Ontario, California), the California Shrike, *Lanius ludovicianus gambeli* (Ontario, California) and the Phainopepla, *Phainopepla nitens* (Ontario, California). This species belongs to Piaget's second group of *circumfasciati*, and resembles *platyclypeatus* P. and *frater* (Les Pediculines, p. 145, pl. xii, figs. 1 and 2) from *Motacilla alba* and *Lamprotornis amethystina*, respectively.

Description of the female. Body, length 2.21 mm., width .75 mm.; abdomen broad for *Nirmus*, pale fuscous, head darker than the thorax or abdomen, narrow dark lateral borders on the head and thorax, but no dark lateral abdominal bands; pale brown median, transverse abdominal blotches.

Head, length .56 mm., width .43 mm.; clypeal front varying from narrowly to broadly parabolic, with four short hairs on the margin, a short marginal prickle before the trabeculæ, and two long dorsal hairs

arising before the trabeculæ, which are small, yet distinct; antennæ short, segment 2 longer than the other segments, segment 5 longer than segments 3 or 4, a few short hairs on the segments; eye distinct, with one very long hair and a short prickle at its posterior angle; temples rounded, with two long marginal hairs and two or three short prickles; occipital margin straight; head of a general dark fulvous, clypeal front paler, clearer yellow brown; antennal bands very narrow, blackish brown, strictly marginal and not extending far anteriorly; antennæ an even, pale fuscous; ocular blotches dark and extending angularly inward; temples with a narrow border of blackish brown.

Prothorax with sides rounding and slightly divergent, with a long hair in the posterior angle; three short dorsal spines near the anterior angle, two near the median line, and one nearer the lateral margin; lateral margins with irregular dark borders; intercoxal lines showing through from the under side distinctly, as sharply defined lines, directed in towards the median line, before the posterior margin. Metathorax but little wider than the prothorax, slightly constricted near the anterior angles; posterior angles broadly rounded, with one short hair and one spine; posterior margins nearly straight on the abdomen, except for the acute median angle; a series of long pustulated hairs on the posterior margin each side of the acute angle. Legs pale fuscous without definite markings.

Abdomen broadly elliptical; angles of segments not projecting, a series of long hairs on the posterior margin of the segments; transverse bands an even, pale fuscous, indistinct to wanting, without darker lateral bands; last segment broadly rounding, with slight emargination, two or three short marginal hairs and several long dorsal hairs; ventral surface with broad median transverse bands of dark fuscous; blotches of the last segment posteriorly emarginate and laterally interrupted by the pustulations of two long hairs; these ventral blotches show through above.

Nirmus ductilis n. sp. (Plate VI, fig. 8).

One female from a Western Flycatcher, *Empidonax difficilis* (Ontario, California). A member of the group *interrupto-fasciati*, but well distinguished by its sharp, distinct, blackish marginal markings, without trace of median abdominal blotches.

Description of the female. Body, length 1.9 mm., width .4 mm.; long, slender, transparent white, with narrow, distinct, blackish lateral margins of head and abdomen.

Head, length .37 mm., width .28 mm.; elongate, conical, front narrow and slightly concave; a few short hairs along the margin of the front, the longest hair in front of the trabeculæ, which are small but distinct and uncolored; antennæ with second segment longest, segment 5 longer than segments 3 or 4, segments 1 and 2 pale transparent whitish, segment 3 with a slight shade of brown, segments 4 and 5 dark brown; eye with a prickle; temporal margins with one long hair and two or three prickles; occipital margin slightly convex; antennal bands narrow, blackish brown, fading out along the inner margins and anteriorly, before reaching the uncolored frontal margin, the posterior extremities bending angularly in, meeting the dark ocular blotches which in turn meet the dark brown marginal borders of the temples.

Prothorax with flatly rounding lateral margins and posterior angles, dark blackish brown lateral borders, which bend in and back on the anterior and posterior extremities, the posterior borders almost meeting on the median line. Metathorax as wide as the head, sides diverging strongly; posterior angles with three or four long hairs, a series of pustulated hairs along the outer third of the posterior margin that is rounded upon the abdomen; dark, interrupted lateral blotches narrow and marginal on the anterior angles, and large, irregular submarginal blotches, darker near the posterior angles, growing paler near the middle. Sternal markings consisting of distinct intercoxal lines and a pale brown median blotch on the metasternum. Legs translucent whitish with blackish brown marginal bands and semi-annulations.

Abdomen very long, elliptical, with subparallel sides not tapering posteriorly until after segment 7; posterior angles of the segments slightly projecting, each bearing one weak hair, till segment 7, which has two hairs in the angle; segment 8 has one lateral marginal hair besides two hairs in the posterior angle; segment 9 broadly rounding, with angular emarginations, two short hairs on the posterior margin; two dorsal hairs arising near the posterior angle of each segment except segment 8 which has a series of posterior marginal hairs; pale translucent whitish with distinct, narrow blackish brown linear bands on the lateral margins of segments 1 to 7; segment 8 with small pale brown blotches near the lateral margin and one pale brown blotch on the median line; last segment uncolored; genital blotches pale brown, linear each side of the median line on the posterior margin of segment 7, also a pale brown blotch on the median line of segment 6.

Nirmus lautiusculus n. sp. (Plate VI, fig. 9).

A single male from a Bell's Sparrow, *Amphispiza belli* (Ontario, California). The new species, strikingly marked, is a member of the group *interrupto-fasciati*, in general shape like *vulgatus* K. (New Mallophaga II, p. 496, pl. lxvii, fig. 5) and with the characteristic angulated, colored internal border of the antennal fossa. In the distinctness and contrast of the markings it recalls *illustris* K. (New Mallophaga II, p. 494, pl. lxvii, fig. 4).

Description of the male. Body, length 1.65 mm., width .4 mm.; translucent whitish with sharp, black, narrow marginal bands on head and abdomen; legs with annulations and semiannulations; thorax with intercoxal lines showing through distinctly, and abdomen with median linear brown transverse blotches, two to a segment, on ventral aspect.

Head, length .34 mm., width .31 mm.; front narrow, slightly convex; two or three short hairs on the lateral margin of the front; a short prickle in front of the trabeculæ which are distinctly angular and uncolored; antennæ long; segment 2 longer than other segments, segment 5 distinctly dark brown; eye prominent, with two prickles, one on the eye itself and a second just at its posterior angle; temples rounding, with one very long hair, one short fine hair, and three short prickles; occipital margin straight and bare; antennal bands narrow, clearly defined, not fading inwardly, their anterior extremities separated by the uncolored clypeal front, interrupted just before the trabeculæ by a distinct uncolored space, posterior extremities acutely meeting the dark narrow bands that angularly margin the antennary fossæ and the eye; the temples irregularly dark on the margins; the occipital signature distinctly showing through as a narrow brown blotch on the occipital margin and in front as a triangular blotch.

Prothorax with rounding lateral margins and posterior angles; three short spines on the dorsal surface in each anterior angle; a dark blackish brown blotch in the anterior angles, and a narrow black band along the posterior margin, widening as it reaches the angle. Metathorax longer than the prothorax, with sides diverging; a series of six long hairs on the posterior margin which is narrowly rounded upon the abdomen; anterior angles with a small blotch of dark brown. Sternal markings showing through distinctly, the intercoxal lines of the metasternum appearing as a dark transverse band across the metathorax, the lateral extremities not reaching the margin but bending irregularly backward, abruptly stopping before they reach the posterior angle. Legs translucent with dark annulations and semiannulations.

Abdomen narrowly elongate, segments 1–7 with narrow, sharply defined black lateral bands; last segment uncolored, narrowly rounding, with several long dorsal hairs; the ventral surface of segments 1–6 with two median, linear brown transverse blotches on each segment; these blotches are united on segment 6 by a brown median line; segment 7 with two longitudinal brown blotches each side of the median line approaching each other anteriorly; two very small brown blotches on the last segment near the anterior angle.

Nirmus longus Kellogg.

New Mallophaga, II, 1896, p. 490, pl. lxvii, fig. 1.

A single male from the Barn Swallow, *Chelidon erythrogastra* (Palo Alto ? California). This specimen differs distinctly from the type specimens in having but three instead of six lateral metathoracic hairs, in the more elongate head, and in the distinctness of the median uncolored longitudinal line of the abdomen. It should be distinguished by a varietal name.

Var. *domesticus* Kellogg and Chapman; one male from the Barn Swallow, *Chelidon erythrogastra* (California); body, length 1.54 mm., width .41 mm; head, length .37 mm., width .31 mm.; thus being of about same size as the species type, and twice as long as Nitzsch's *gracilis*, the common *Nirmus* of the European swallows. Characters of species with differences as noted above. Osborn (Insects Affecting Domestic Animals, 1896, p. 225) refers a specimen from the Purple Martin, *Progne subis* (Ames, Iowa), to *gracilis*. He does not give the measurements of his specimen.

Nirmus brachythorax Giebel.

Insecta Epizoa, 1874, p. 134.

Nirmus brachythorax G., Piaget, Les Pediculines, 1880, p. 150, pl. xii, fig. 8; Osborn, Insects Affecting Domestic Animals, Bull. 5, N. S., Div. of Ent., U. S. Dept. Ag., 1896, p. 223.

Specimens from two Cedar Waxwings, *Ampelis cedrorum* (Palo Alto, California). Osborn's specimens were from same host (Ames, Iowa). Giebel's types are from same host.

Lipeurus.

Lipeurus laculatus n. sp. (Plate VII, fig. 1).

Four specimens collected of this strikingly marked *Lipeurus;* an adult male and an immature individual from a Pomarine Jaeger, *Stercorarius pomarinus*, and an adult male and an immature from a Pink-footed Shearwater, *Puffinus creatopus* (Bay of Monterey, Calif.) We believe that the specimens from the Shearwaters are stragglers from the Jaeger. (We have examined so many Shearwaters that, were the species a regular parasite of *Puffinus*, we should have taken other examples.) One other individual of *Stercorarius pomarinus* was examined, but no *Lipeurus* was found on it. The new species shows no special resemblances to any of the described *Lipeuri* of allied hosts.

Female. Body, length 4.06 mm., width .78 mm.; slender, transparent whitish with distinct black marginal markings on the head, thorax, legs, and abdomen, broad transverse bands of dark chestnut showing through the dorsal surface of the abdomen.

Head, length 1. mm., width .59 mm.; elongate, conical, sides nearly parallel, clypeal front rather narrowly rounded, with five marginal hairs, four of which arise from the anterior part of the clypeus, being about equidistant, the fifth hair is in front of the very small trabeculæ; two dorsolateral hairs, one near the first anterior marginal hair and the other between the third and fourth marginal hairs; antennæ with segment 2 longer than the other segments, segments 1, 2 and 3 uncolored, segment 4 dark brown, segment 5 lighter brown; eye distinct, with a short prickle; temporal margins nearly parallel, with one hair and four short prickles; anterior margin of the clypeus uncolored; a wide, distinct signature with convex, posterior margin; color even chestnut-brown; antennal bands broad, black, sharply defined, except at the anterior portion where they extend indistinctly toward the median line of the head; temporal margin distinctly bordered with black, narrowing posteriorly; occipital blotches black and angular.

Prothorax quadrangular, sides parallel; a short prickle in the posterior angles; pale transparent brown, with broad black lateral borders following the margins of the anterior and posterior angles. Metathorax longer than broad, widest at the posterior angles; posterior margin straight; ground color slightly darker brown than the prothorax, with irregular, black marginal bands fading just back of the anterior angles, and with an emargination at their posterior extremity where four long pustulated hairs and one short hair arise; one short hair on the posterior angle. Legs concolorous with the pale color of the prothorax, with black annulations and marginal bands; front legs short, femora wide, with small black marginal markings; second and third pair of legs long; coxæ produced and widely separated, with dark dorsal annulations; femora long and slender, with narrow black marginal markings; tarsi and claws pale brown; several scattered hairs and spines on the legs. Sternal markings composed of intercoxal lines between pro- and mesolegs, and a large suboblong, metathoracic, median blotch with rounded angles.

Abdomen with sides of segments 1–7 parallel; segments 8 and 9 suddenly narrowed and very small; posterior angles of the segments with from one to four long hairs; segment 9 narrowly emarginate, with two long hairs on each of the posterior angles; ground color transparent whitish, with black lateral marginal bands which extend inward along the anterior and posterior margins; these lateral bands are inwardly emarginated by an uncolored space surrounding the stigmata; on the ventral aspect fulvous transverse bands, concave posteriorly; segment 7 with two longitudinal, lateral fulvous blotches; segment 8 with irregular black marginal bands; segment 9 wholly dark brown to black.

Lipeurus diversus Kellogg.

New Mallophaga I, 1896, p. 123, pl. viii, figs. 3 and 4.

Many specimens from thirteen out of thirty-four individuals shot of the Black-vented Shearwater, *Puffinus* *opisthomelas*, from twelve out of fourteen individuals shot of the Dark-bodied Shearwater, *P. griseus*, from five out of six individuals shot of the Pink-footed Shearwater, *P. creatopus*, from a single specimen shot of *P. bulleri*, from a single specimen shot of *P. tenuirostris*, and a single specimen, probably straggler, from a Short-tailed Albatross, *Diomedea albatrus* (all the birds from the Bay of Monterey, California). The species was described from *Puffinus opisthomelas* (same locality).

This species and *Lipeurus angusticeps* Piaget (Les Pediculines, p. 306, pl. xxv, fig. 4) from *Thalassidroma leachi*, and *Lipeurus abnormis* Piaget (Supplement, p. 65, pl. vii, fig. 2) from *Puffinus major*, are closely related. There is a regular sequence in size from *angusticeps* through *diversus* to *abnormis*. It may be suspected that we have to do with one species of great variation in size; but the diagnostic characters of the three species are sufficiently important to justify the separation of the forms.

Lipeurus densus Kellogg.

New Mallophaga II, 1896, p. 114, pl. vii, figs. 1 and 2.

Two females and a male from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Types taken from *Diomedea albatrus* and *D. nigripes* (see Kellogg, Mallophaga from Birds of Panama, Baja California and Alaska, in New Mallophaga III, p. 28, pl. iii, fig. 2). These specimens fully confirm the specific idendity of the female described in New Mallophaga II, p. 114, and the male described in New Mallophaga, III, p. 28. The females now taken are almost, if not quite, as large as the male, and they are also quite as fully blotched and colored.

Lipeurus ferox Giebel. (See Kellogg, New Mallophaga, I, 1896, p. 127, pl. ix, figs. 1 and 2).

One male from the Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Previously taken by Kellogg from same host species (same locality). The description and figure which Taschenberg (Die Mallophagen, 1882, p. 145, pl. v, fig. 1 *a*) gives for the female of *Lipeurus ferox* apply in reality, we believe, to the male of *Lipeurus densus* Kellogg (See Mallophaga from Birds of Panama, Baja California and Alaska, in New Mallophaga, III, 1899, p. 28, pl. iii, fig. 2).

Lipeurus concinnus n. sp. (Plate VII, fig. 2).

A male and a female from the Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). A slender, graceful form of the *clypeati sutura indistincta*, not much resembling any of the *Lipeuri* hitherto taken on the Albatross.

Description of the male. Body, length 3. mm., width .53 mm.; slender, pale, with distinct black marginal markings, and brown head and transverse abdominal blotches.

Head, length .65 mm., width .4 mm.; elongate, conical, front rounded, four long marginal hairs and one short one before the antennal angle; a long hair, arising from the dorsal surface between the first and second marginal hairs, extends beyond the margin; antennæ with segment 1 nearly as long as all the other segments, segment 2 about one-third as long as segment 1, segment 3 short, with a dorsal, angular, distal appendage, segment 5 longer than segment 4, segments 4 and 5 and the tip of the appendage of segment 3 light brown, antennæ elsewhere uncolored; eyes distinct but not

protruding; temples convex, hind-head widest about half way between the eyes and the posterior angles; margin with no long hairs, but with a short curving hair and a few prickles; occipital margin straight; head all brown, except small, nearly uncolored part of clypeal front, and antennæ, of which the first three segments are uncolored, last two pale brown; narrow marginal antennal bands; small signature, widest anteriorly and extending posteriorly in a fading, acuminate point; indistinct occipital bands and temporal borders blackish; anterior horns of the prothorax showing through, producing the effect of black triangular blotches at the base of the occipital bands.

Prothorax quadrangular, straight in the middle third on the metathorax; one very short hair in the posterior angle; general color transparent whitish, with distinct, even black lateral borders. Metathorax with lateral margins slightly convex before the middle; longer than broad; posterior margin slightly angulated upon the abdomen; three long hairs and two shorter hairs in the posterior angles; general color pale transparent brownish, with irregular lateral bands of black, expanding near the anterior angles into conspicuous triangular blotches, narrower below these blotches than the lateral bands of the prothorax. Legs long, slender, transparent, with black bands on femora and tibiæ; tibiæ and tarsi brown, a few scattered hairs on the legs. Prosternum with curving intercoxal lines; a medial, metathoracic, sternal blotch oblong, darker on the posterior half.

Abdomen slender, elongate, slightly widening to segment 4, then tapering gradually to segment 9; segment 2 longer than the other segments, while segments 4 and 5 are narrow, especially in the middle; posterior angles but slightly extending, with from one to four hairs; segment 8 with six long posterior marginal hairs; general ground color of the abdomen, after segment 1, which is transparent whitish, dark brown; lateral markings black, of segment 1 they are anterior and angular, of segments 2 to 7 broadly extending towards the median line on the anterior half of the segments, while the posterior portion is darker and more definitely angular, this lateral band is deeply emarginated interiorly by a light brown blotch; the broad transverse bands are darker on the anterior margin, and the posterior margins of these transverse bands are emarginated by a pale brown band; segment 8 an even brown with very narrow dark lateral bands; segment 9 very small, rounding, of an even brown, with two long and two short hairs on the posterior margin.

Female. Body, length 3.63 mm., width .68 mm.; head, length .68 mm., width .43 mm.; first and second segments of antennæ nearly equal and as long as the other three segments, segment 5 longer than segment 4, segments 4 and 5 slightly colored with brown; eyes larger and more prominent than in the male; segments of the abdomen more nearly equal than in the male; segments 8 and 9 suddenly narrower than segment 7; segment 8 with a strong conspicuous hair in each anterior angle; six hairs along the posterior margin and eight small hairs in a transverse curving line on the ventral aspect; segment 9 with one hair in each anterior angle and two strong hairs on each of the two obtuse points, separated by the angular emargination of the posterior margin. Abdominal markings limited to dark brown to black, lateral blotches with pale, indistinct stigmatal spots; segments 7 to 9 almost wholly brown, with a narrow, distinct, uncolored median line; lateral parts of segment 7 blackish brown.

Lipeurus testaceous Taschenberg. (See Kellogg, New Mallophaga, I, 1896, p. 130, pl. xi, figs. 2 and 4).

A few specimens, rarely more than one or two from a bird, from eight out of thirty-four individuals shot of the Black-vented Shearwater, *Puffinus opisthomelas;* not found on any one of fourteen individuals shot of *P. griseus;* found on one out of six individuals shot of *P. creatopus;* and not found on the single specimen examined of *P. bulleri*, nor of *P. tenuirostris*, all from the Bay of Monterey, Calif. Taken previously by Kellogg from *Puffinus opisthomelas*, same locality. We have no males among the few specimens collected.

Lipeurus limitatus Kellogg.

New Mallophaga, I, 1896, p. 124, pl. viii, figs. 5 and 6.

Many specimens from five out of thirty-four individuals shot of the Black-vented Shearwater, *Puffinus opisthomelas;* from five out of fourteen individuals shot of *P. griseus;* from none out of six individuals shot of *P. creatopus;* from a single individual shot of *P. bulleri*, and from a single individual shot of *P. tenuirostris*, all from the Bay of Monterey, California. Described from three females from *P. griseus*, same locality. We are unable to find any males among our rather many specimens.

Lipeurus fuliginosus Taschenberg. (Plate VII, fig. 3).

Die Mallophagen, 1882, p. 156, pl. iv, fig. 3.

Numerous examples from the Shearwaters, *Puffinus opisthomelas* and *creatopus* (Bay of Monterey, California). Taken from eight out of thirty-four birds shot of *opisthomelas*, from one out of six birds shot of *creatopus*, and not found on any one of fourteen birds shot of *griseus*. The American specimens differ from the types of *fuliginosus*, which were collected from *Diomedea exulans* and *chlororhyncha* by being larger, by showing no difference in the clypeal front of male and female, by having no short hair in the eye, and in other minor characters. We make a variety, therefore, for them.

Var. *major* Kellogg and Chapman. (Plate VII, fig. 3). In the following table of dimensions the figures enclosed in parentheses are the measurements given by Taschenberg for the type specimens. Male. Body, length 3.75 mm. (3.32 mm.), width .9 mm. (.58 mm.); head, length 1. mm. (.89 mm.), width .66 mm. (.55 mm.) Female. Body, length 3.9 mm. (3.72 mm.), width .94 mm. (.66 mm.); head, 1.05 mm. (.9 mm.), width .7 mm. (.59 mm.). From these measurements the head of the variety is proportionately wider than in the type forms. The species is recognizable by its dark color and the characteristic double set of internal bands in the forehead.

Lipeurus farallonii Kellogg. (Plate VII, fig. 4).

New Mallophaga, I, 1896, p. 103, pl. v, fig. 4.

Many specimes from two individuals of Brandt's Cormorant, *Phalacrocorax penicillatus* (Bay of Monterey, California). Described (as a *Nirmus*) from a single female from a Farallon Cormorant, *Phalacrocorax dilophus albociliatus* (Bay of Monterey, California). The finding of the males of this species shows that it is a *Lipeurus* of the group *clypeati sutura distincta* and allied to Piaget's *setosus*, *sub-setosus*, *et al.* taken from various cormorants. The marked difference in size, outline and marking of the two sexes is striking, and likely to be confusing to students who may happen to meet but one sex. Is it possible that Piaget's *Nirmus dispar*, which the female of *farallonii* resembles, can be the female of some one of these *Lipeuri* of the cormorants?

Description of the male. Body, length 1.72 mm., width .36 mm.; head, length .43 mm., width .37 mm.; head like female, perhaps a little narrower, comparatively, behind; antennæ with segments 1 and 2 rather large, subequal, segments 3 and 4 very small, subequal, and segment 5 as long as 3 and 4 together, no distinct appendage; metathorax with sides nearly parallel, not plainly divergent as in female; abdomen slender, sides subparallel, ground color pale golden with wide whitish transverse sutural bands and prominent brown, shining subcircular lateral blotches not touching the narrow, inconspicuous blackish lateral bands; last segment truncate behind, with a group of four prominent hairs on each lateral half of the margin.

Lipeurus forficulatus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 129, pl. ix, figs. 3, 4, 5 and 6).

Specimens from a Californian Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California). Taken previously by Kellogg from same host species, same locality; and from the White Pelican, *P. erythrorhynchus* (Lawrence, Kansas.)

Lipeurus squalidus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 132, pl. x, figs. 6 and 7.)

Six specimens from a Shoveller, *Spatula clypeata* (Palo Alto, California). These specimens resemble very much those specimens which Kellogg collected from *Merganser serrator* (see New Mallophaga, I, p. 130, pl. x, fig. 1). In fact, we fail to make out any good distinction between the species *temporalis* Nitzsch (found on the Mergansers) and the species *squalidus* of *Anas* and allied ducks.

Lipeurus docophoroides Piaget. (See Kellogg, New Mallophaga, II, 1896, pl. lxviii, fig. 8).

Two female specimens from a Plumed Partridge, *Oreortyx pictus plumiferus* (El Dorado county, California). These specimens differ distinctly in the less pointed front from *L. docophoroides* taken by Kellogg from *Callipepla californica*, and in this form a link between *docophoroides* and *dissimilis* Piaget (see Kellogg, New Mallophaga, II, 1896, p. 507, pl. lxviii, fig. 7). We have given these specimens a varietal name.

Var. *californicus* Kellogg and Chapman, from the Plumed Partridge, *Oreortyx pictus plumiferus* (El Dorado county, California); clypeal front not so pointed as in the species type, but approaching the rounded front of *dissimilis* P.; without signature; all the antennal segments colored, at least slightly, instead of only the last three as in the species type; the pustulated hairs of the body very long (longer than in the typical species forms).

Lipeurus perplexus n. sp. (Plate VII, fig. 5).

Two females from a Columbian Sharp-tailed Grouse, *Pedioecetes phasianellus columbianus* (Pullman, Washington), and many females, differing slightly in shape of metathorax and abdomen, from a Sooty Grouse, *Dendragapus obscurus fuliginosus* (Kings River Cañon, California). A peculiar broad, robust form of the group *circumfasciati*, with rounded front. Resembling Piaget's *L. opimus* (Supplement, p. 78, pl. viii, fig. 6) from *Turacus giganteus* (Museum of Leyden). Resembling also in general outline and characters Osborn's *Nirmus cordatus*, a specimen of which we have taken from *Limosa hæmastica*. Perhaps both of these forms should be referred to the same genus. Piaget's *L. opimus* should accompany them. Unfortunately, all of these species are represented by females only.

Description of female. Body, length 2.06 mm., width .59 mm.; short, broadly elliptical body, with short, broad head, broadly rounded in front; clear fulvous with pale golden brown lateral, transverse abdominal blotches.

Head, length .53 mm.; width .5 mm.; cordate, clypeal front broadly rounded, four short marginal hairs on the front, a short hair on the margin in front of the antennæ which are short; segment 2 of the antennæ longer than segment 1, segment 5 longer than segments 3 or 4; the anterior end of segment 3 and segments 4 and 5 pale fulvous, a few short hairs on the segments; eye prominent, a long hair rising from its dorsal surface, and with a conspicuous black fleck; temples convex, with two long hairs and two or three short prickles; occipital margin slightly concave; antennal bands slightly darker on the posterior tips and continuous as a narrow, even marginal border of pale translucent golden brown on the front; narrow, occipital blotch of pale golden brown, also a temporal border and an occipital band of the same color; mandibles dark chestnut-brown, showing through the head.

Prothorax short, lateral margins convex; one hair in the posterior angle; pale fulvous, slightly darker on the lateral margins. Metathorax with sides diverging, posterior angles rounding, with a long hair and short prickle; four hairs on the posterior margin in groups of two in small, uncolored pustulations; posterior margin with a slight angle on the abdomen; pale fulvous, slightly darker on the posterior angle; all of the thorax with a more whitish ground color than the head. Sternal markings consisting of pale intercoxal lines and a very pale median metathoracic blotch. Legs pale fulvous with narrow dark marginal borders.

Abdomen elongate-ovate, tapering rapidly posteriorly; segments with their posterior angles slightly produced, each with from one to three hairs; a transverse series of a few long dorsal hairs near the middle of the segments; ground color pale fulvous, narrow translucent brown bands on the lateral margins; broad transverse pale brown blotches on segments 2 to 7, darker on their inner ends, separated by a broad pale median line, also a broad pale band on the posterior margin of each segment; segment 8 entirely colored, with slight median emarginations on the anterior and posterior margins of the blotch; no distinct lateral bands; last segment round, narrowly emarginate, with one short hair on the posterior margin of each rounding angle; two transverse blotches, one on each side of the emargination.

Giebelia.

Giebelia mirabilis Kellogg.

New Mallophaga, I, 1896, p. 138, pl. xi, figs. 7 and 8.

Many specimens from twenty-seven out of thirty-four individuals shot of the Black-vented Shearwater, *Puffinus opisthomelas*; from ten out of fourteen individuals shot of the Dark-bodied Shearwater, *P. griseus*; from all out of six individuals shot of the Pink-footed Shearwater, *P. creatopus*; from a single individual shot of *P. bulleri*, and from a single individual shot of *P. tenuirostris*, all from the Bay of Monterey, California. Four specimens, probably stragglers from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California. The species was described from *P. opisthomelas*.

Oncophorus.

Oncophorus bisetosus Piaget. (Plate VII, fig. 6).

Les Pediculines, 1880, p. 217, pl. xviii, fig. 4.

Several specimens from the Californian Clapper Rail, *Rallus obsoletus* and the Virginia Rail, *Rallus virginianus* (Palo Alto, California). Piaget's specimens were taken from *Rallina plumbeiventris*, *R. tricolor* and *R. isabellina*. He also found specimens on a Yellow Rail, *Porzana noveboracensis* (from North America, in the Museum of Leyden). The specimens from this last bird are distinguished by the varietal name *porzanæ*, being slightly larger than the type specimens and showing certain small differences in hairs and markings. Our specimens from *Rallus obsoletus* and *R. virginianus* agree with var. *porzanæ* in departing in the matter of size and hairs of dorsal surface of abdominal segments from the type specimens, but go farther in differing and must be distinguished by a varietal name.

Var. *californicus* Kellogg and Chapman. (Plate VII, fig. 6). From the Californian Clapper Rail, *Rallus obsoletus* (Palo Alto, California) and the Virginia Rail *Rallus virginianus* (Palo Alto, California). (In the following list of measurements the figures in parentheses are those given by Piaget for the type specimens). Female. Body, length 1.72 mm. (1.35 mm.), width .5 mm. (.47 mm.); head, length .53 mm. (.47 mm.); width .4 mm. (.38 mm); seven hairs on margin of forehead, of which two are longer and dorsal, instead of six with one dorsal as in the types; a prominent hair in the eye not mentioned in the description of the types; two median hairs on dorsal aspect of each abdominal segment, as in the variety *porzanæ* Piaget, instead of four as in the species type. The female has large quadrangular, transverse, lateral abdominal blotches separated by a narrow median uncolored line hardly apparent on segments 6–9; a strong uncolored transverse line between segments 7 and 8; lateral bands black, distinct, segmented. In the male the transverse abdominal blotches are continuous across the segments, with widely separating, uncolored, transverse sutures, especially on posterior half of abdomen.

Oncophorus remotus n. sp. (Plate VII, fig. 7).

A male and female from a Great Gray Owl, *Scotioptex cinerea* (Pullman, Washington). Not at all like *O. heteroceras* Piaget (Les Pediculines, p. 222, pl. xviii, fig. 8) from *Strix bubo*, which has the head varying markedly in the sexes; and not like *O. hexopthalmos* Nitzsch (described by Nitzsch as a *Lipeurus* and referred by Giebel to *Ornithobius*, and by Piaget to *Oncophorus*) from *Strix nyctea*.

Description of the male. Body, length 2.02 mm., width .93 mm.; short, broad; pale golden brown, with slightly darker bands on the head and thorax.

Head, length .65 mm., width .59 mm., subpentagonal, broadly rounding in front; clypeus slightly convex, two hairs on each side of the uncolored clypeal front, a third marginal hair in front of the suture; a long marginal hair and short prickle in front of the trabeculæ which are long and acutely angular; antennæ with its first segment as long as all the other segments taken together, third segment with slight but appreciable distal projection, a few short spines on the segments; eye with a distinct ocular fleck and a long hair; temples with sides nearly straight, two long hairs and two prickles on the margin; occipital margin straight, without hairs or prickles; general color of the head pale golden brown; clypeal signature very pale brown but distinct, anterior margin slightly concave; antennal bands interrupted at the suture, darker chestnut-brown at the posterior extremities, which are turned almost at a right angle with the anterior half and lie half way between the mandibles and base of the antennæ; distinct, angularly contorted, inner bands paler than the antennal bands; occipital bands pale anteriorly, growing darker and more sharply defined near the occipital margin.

Prothorax quadrangular, with rounded posterior angles, with one long hair; sternal markings showing through as dark bands near the lateral margins, bending inwardly before the posterior margin, and separated by a distinct, uncolored median line. Metathorax with convex, divergent sides, a long slender hair and a prickle on the lateral margin, near the posterior angle, three long hairs in the posterior angle; a series of hairs along the rounding, posterior margin. Legs pale brown, with a few scattered spines.

Abdomen broadly elliptical, narrowing at both extremities; a few long hairs in the posterior angles of the segments; a transverse series of hairs on the posterior margins of the segments; segments 5, 6 and 7 narrowed in the middle; last segment narrowly rounding, pointed, with two long hairs on the posterior margin; ground color very pale golden brown; transverse lateral blotches indistinct, separated by a broad uncolored median space, except on segment 5, where the transverse band extends across the entire segment; segments 6, 7 and 8 with a broad median blotch of darker golden brown; segment 9 entirely brown; there are but slight indications of defined lateral marginal bands; genitalia distinct, dark golden brown, broad and complex.

Female. Body, length 2.5 mm., width .93 mm.; head, length .71 mm., width .75 mm. The shape of the head different, the temporal margins being distinctly convex; segments 1 and 2 of the antennæ as long as segments 3, 4 and 5, but segment 2 longer than segment 1. Abdomen widely ellipitical, but distinctly more elongate and less narrowed posteriorly; very pale golden brown; last segment emarginate, with rounding lateral halves.

Eurymetopus.

Eurymetopus taurus Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 135, pl. xi, figs. 3, 4, 5 and 6).

Two females from two specimens of the Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Previously taken by Kellogg from same host species (same locality). A single immature specimen, probably a straggler, from a Black-vented Shearwater, *Puffinus opisthomelas* (Bay of Monterey, California).

Goniodes.

Goniodes mammillatus Rudow. (See Kellogg, New Mallophaga, II, 1896, p. 509, pl. lxix, fig. 2).

Two immature specimens from a Columbian Sharp-tailed Grouse, *Pediocætes phasianellus columbianus* (Pullman, Washington). Previously taken by Kellogg from *Callipepla californica* (California).

Colpocephalum.

Colpocephalum perplanum n. sp. (Plate VII, fig. 8).

One specimen from a Tufted Puffin, *Lunda cirrhata* (Bay of Monterey, California). This form resembles

C. latifasciatum Piaget (Supplement, p. 130, pl. xiv, fig. 2), from *Rhynchops flavirostris*. The difference in size, number of hairs of the temples, and character of abdominal segments, together with the unrelated host leads us to make the specimen the type of a new species.

Description of female. Body, length 1.84 mm., width .67 mm.; golden brown, with ill-defined, median, transverse abdominal bands, and small dark brown marginal abdominal blotches; head and thorax with blackish markings.

Head, length .35 mm., width .54 mm.; broadly and flatly rounded in front, with numerous, rather long, and a few short, marginal hairs; one very long marginal hair just in front of the ocular emargination, and two shorter hairs directly on the angle; ocular emargination pronounced and acutely angled interiorly; eye prominent, emarginated, with a large ocular fleck; ocular fringe distinct; antennæ with last segment broad, extending beyond the head; temples with anterior angles rounding, posterior angles angularly meeting the occipital margin; three very long and some shorter hairs on the temporal margin; the occiput slightly concave, with four rather long marginal hairs; a narrow, curving, fuscous band running parallel with the clypeal margin, ending at the lateral extremities in a dark chestnut spot; distinct, black, irregular, ocular blotch; triangular bases of occipital bands blackish brown, connected by an even, occipital border, narrowing medially.

Prothorax broad, lateral angles acute, bearing one long hair and a short spine, sides converging posteriorly, with one long hair in the posterior angles; a series of long hairs on the posterior margin. Mesothorax separated from the metathorax by a distinct, lateral constriction, the posterior margin being distinctly marked with a dark brown band that turns in at the anterior angles along the lateral margins. Metathorax with anterior angles extending beyond the posterior margin of the mesothorax; sides divergent, posterior angles with two long hairs and two short spines; posterior margin straight on the abdomen, with a series of long hairs. Legs robust, concolorous with the metathorax.

Abdomen long, ovate; segments equal, with one or two long hairs and spines in posterior angles, and one or two short spines on lateral margins of each segment; dorsal surface with a single transverse series of hairs along the posterior margin of each segment; the ventral surface with several series of weakly pustulated hairs on each segment; last segment flatly convex, with two dorsal hairs near the lateral margins; ground color pale fuscous, with unevenly colored lateral border of darker fuscous, paling on the outer margins and darkest in posterior angles of segments and along inner margin; a longitudinal, narrow, uncolored, submarginal line parallel with the lateral margin; ill defined, transverse bands slightly darker fuscous.

Colpocephalum funebre Kellogg.

New Mallophaga, I, 1896, p. 147, pl. xii, fig. 7.

One specimen from *Larus heermanni* (Bay of Monterey, California). Described from specimens from *Larus glaucescens* (Bay of Monterey, California).

Colpocephalum pingue Kellogg.

New Mallophaga, I, 1896, p. 144, pl. xii, fig. 5.

One specimen, male, from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Described from the same host species (same locality).

Colpocephalum spinulosum Piaget. (Plate VII, fig. 9).

Les Pediculines, 1880, p. 563, pl. xlvii, fig. 3.

Many specimens from eight out of fifteen individuals examined of the Sanderling, *Calidris arenaria* (Pacific Grove, California). The specimens agree in all essential details of outline and markings with Piaget's description, showing the characteristic, finely pustulated, dorsal surface of the male, with the single transverse series of long pustulated hairs on each segment in the male and the two series in the female. But there is a marked difference in size, the species type being one-fourth larger than our specimens. Piaget's specimens were taken from *Limosa melanura* (Musuem of Leyden). The American specimens should be distinguished by a varietal name.

Var. *minor* Kellogg and Chapman. (Plate VII, fig. 9). In the following table of measurements the figures in brackets are the dimensions given by Piaget for his type specimens. Male. Body, length 1.72 mm. (2.1 mm.), width .5 mm. (.64 mm); head, length .31 mm. (.38 mm), width .34 mm. (.5 mm). Female. Body, length 2.16 mm. (2.45 mm.), width .7 mm. (.86 mm.); head, length .37 mm. (.38 mm.), width .5 mm. (.5 mm.) From the Sanderling, *Calidris arenaria* (Pacific Grove, California.)

Colpocephalum timidum Kellogg.

New Mallophaga, I, 1896, p. 145, pl. xii, fig. 6.

One specimen from a Black-bellied Plover, *Squatarola squatarola* (Pacific Grove, California). Described from *Charadrius dominicus* (Lawrence, Kansas).

Colpocephalum flavescens Nitzsch. (See Kellogg, New Mallophaga, II, 1896, p. 525, pl. lxxi, fig. 4).

Specimens from the Golden Eagle, *Aquila chrysäetos* (Palo Alto, California) and from a Siberian Eagle, *Haliæetus pelagicus* (brought alive from the Arctic Ocean to California). Taken previously by Kellogg from *Haliæetus leucocephalus* and *Archibuteo lagopus sancti-johannis* (Kansas). Taken by Osborn from "Swallow-tailed Kite" (Ames, Iowa).

Colpocephalum grandiculum n. sp. (Plate VII, fig. 10).

One specimen from a California Towhee, *Pipilo fuscus crissalis* (Palo Alto, California). Also a single specimen, much smaller, (otherwise not indicating immaturity) from a Heerman's Song Sparrow, *Melospiza fasciata heermanni* (Palo Alto, California), which, because of the similarity in outline, characters of legs, and general markings, may be referred to the same species. The species resembles in general shape *C. fumidum* Kellogg (New Mallophaga, II, 1896, p. 523, pl. lxxi, fig. 5) from a California Bush-Tit, *Psaltriparus minimus californicus* (Palo Alto, California).

Description of female. Body, length 2.28 mm., width .81 mm.; head and thorax fulvous, abdomen dull fuscous; small ocular and occipital blotches, very narrow marginal, lateral, abdominal bands; temples produced angularly; a distinct V-shaped uncolored marking between the ocular emarginations, projecting backwards as a more or less distinct uncolored median line through the thorax and abdominal segments 1 to 6.

Head, length .5 mm., width .65 mm.; front broadly rounded, subsemicircular; several hairs on the strictly anterior margin, two rather long hairs on the lateral margin of the front, and two long hairs in front of the ocular emargination; eye distinct, almost if not quite divided, the larger and anterior portion lying in the angle of the ocular emargination, while the smaller, posterior portion lies apparently on a ridge that extends back across the temples; temples prominent; anterior margin almost at right angles with the median line of the head; ocular fringe prominent, extending as far as the anterior temporal angle, a few short hairs on this angle, two long hairs and a few short spines on the lateral margins and the posterior rounding angles; occipital margin medially convex; head smoky, fulvous, distinct, with slightly darker bands extending towards the lateral margin from the base of the mandibles which are dark brown; a V-shaped uncolored marking, each branch extending from the slight swelling in front of the ocular emargination back two-thirds of the distance to the occipital margin, where the uncolored lines meet at the apex of the V; ocular blotches black, even, angular, extending forward as far as the uncolored branch of the V; temples very narrowly bordered with dark brown on the posterior angles; occipital blotches dark brown to black, sharply defined except on the anterior extremity, where they send out a sharp angular blotch; lateral extremities long and gradually narrowing, inner extremities blunt, separated by a fulvous median space.

Prothorax, lateral angles bluntly rounding, with one long hair and a short spine; lateral margin slightly concave, latero-posterior angles with no hair; posterior margin rounding on the mesothorax; two long hairs on the posterior margin near the lateral posterior angles; evenly fulvous, slightly darker on the lateral margins; chitin transverse and longitudinal bars distinct. Mesothorax with sides diverging, posterior angles slightly protruding, separated distinctly from the metathorax, a long hair on the lateral margin, a dark marginal band on the anterior angles. Metathorax narrow, sides diverging, posterior angles rounding, posterior margin straight, with one long hair, one short hair, and a short spine; narrow dark brown marginal band on the anterior angle and lateral border; faint indications of an uncolored longitudinal median line. Legs robust; femora broad; fulvous with darker markings on the border; a series of short hairs on the outer margin of the tibia. Sternal markings consisting of intercoxal lines, a distinct shield-shaped median blotch on the prothorax, a narrow median darker longitudinal blotch between the pro- and mesothorax, a larger median blotch between the second and third pair of legs, with a distinct triangular anterior portion and a quadrangular posterior portion.

Abdomen broadly elongate; posterior angles projecting but little, with one long hair in each angle, and a series of dorsal hairs on the posterior margin of each segment; segments widely separated by uncolored sutures; transverse lateral blotches fuscous, darkening on the lateral margins into narrow bands; segments 1 to 5 with the transverse blotches separated by a narrow uncolored median line; segments 5 to 8 entirely dark fuscous; last segment with broadly rounding posterior margin, one long and one short hair each side and a series of short hairs on the posterior margin; color an even fuscous. Ventral surface a small median triangular fuscous blotch on segment 1; transverse blotches uninterrupted, but the posterior margin of the blotches on segments 2 to 6 emarginated, darker fuscous on the posterior margin; a double series of pustulated hairs and a few scattered hairs on each segment.

Ancistrona.

Ancistrona gigas Piaget. (See Kellogg, New Mallophaga, I, 1896, p. 150, pl. xiii, figs. 1 and 2).

A few specimens from the Shearwaters, *Puffinus opisthomelas* and *P. griseus* (from one individual of *opisthomelas* out of thirty-four examined, and from two of *griseus* out of fourteen examined) from the Bay of Monterey, California. Taken previously by Kellogg from *Fulmarus glacialis* vars. *rodgersii* and *glupischa* (Bay of Monterey, California).

Trinoton.

Trinoton luridum Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 152, pl. xiii, fig. 4).

Specimens from the Baldpate, *Anas americana*, and the American Scaup Duck, *Aythya marila nearctica*, (Palo Alto, California) and from the Shoveller, *Spatula clypeata* (Mountain View, California). Taken previously by Kellogg from two of these hosts, and from other duck species (Kansas and California).

Trinoton lituratum Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 151, pl. xiii, fig. 3).

Specimens from the Shoveller, *Spatula clypeata* (Mountain View, California) and from another individual of the same species (Palo Alto, California). Taken previously by Kellogg from *Dafila acuta* and *Merganser americanus* (Lawrence, Kansas).

Menopon.

Menopon tridens Nitzsch. (See Kellogg, New Mallophaga, I, 1896, p. 165, pl. xv, figs. 3 and 4).

Specimens from an American Eared Grebe, *Colymbus nigricollis californicus* (Bay of Monterey, California); from the Western Grebe, *Æchmophorus occidentalis* (one bird from Washington, and one from California); and from the Californian Clapper Rail, *Rallus obsoletus* (three birds), and the Virginia Rail, *Rallus virginianus* (Palo Alto, California). Taken previously by Kellogg from the two hosts first named, and from *Urinator lumme* (California).

Menopon infrequens Kellogg.

New Mallophaga, I, 1896, p. 161, pl. xv, fig. 5.

Ten specimens from *Larus delewarensis* (Bay of Monterey, California). Described from a single female from *Larus glaucescens* (Bay of Monterey, California). The male is much smaller than the female, as shown by following measurements: body, length 1.4 mm., width .6 mm.; head, length .25 mm., width .53 mm.

Menopon irrumpens n. sp. (Plate VIII, fig. 1).

Four specimens from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). No *Menopon* has been hitherto taken from an Albatross.

Description of female. Body, length 2.23 mm.; width 1.01 mm.; short, broad; dark chestnut-brown with darker blotches on the head and lateral bands on thorax and abdomen.

Head, length .4 mm., width .74 mm.; wide through the temples; clypeus broad, with a slightly angulated front; one rather long and one shorter marginal hair each side of the angular point of the clypeus, a short prickle near the suture; three long marginal hairs on the slight swelling in front of the ocular emargination, two short hairs in front of these, nearer the suture;

ocular fringe distinct, composed of stiff curving hairs which extend slightly on the temporal margin; temples with posterior angles produced; four long pustulated hairs, two shorter hairs, and one short spine on the margin; occipital margin concave, with a series of six long pustulated hairs and one spine; color of the head light chestnut-brown, with dark brown ocular blotches and black ocular fleck, and dark chestnut markings in front, near the mandibles, which show through the head distinctly; occipital margin with a narrow chestnut band, darkening into broad occipital blotches.

Prothorax broad, sides rapidly converging posteriorly; lateral angles narrowly rounding, with a short spine and a long pustulated hair in the angle, a series of fourteen strong hairs along the convex posterior margin; general color dark chestnut-brown, except the space above the conspicuous dark transverse chitin bar, which is pale fuscous; the longitudinal bars, at the ends of the transverse bar, are narrow but distinct. Metathorax short, hardly broader than the prothorax; sides divergent, with two spines on the lateral margins; two long hairs and two short spines on the posterior angles; a series of long pustulated hairs on the posterior margin not so heavy, however, as those of the prothorax; color chiefly dark chestnut-brown, transverse band darkening into a narrow black line along the lateral margin, and into a broad triangle in the posterior angles; in front of this dark band, a pale, broad, mesosutural band, and in front of this the pale brown mesothorax. Legs of the palest fuscous of the prothorax, with several short, stiff hairs on the femora and tibia.

Abdomen broadly elliptical, with several short spines on the lateral margins of the segments, and from one to five long hairs in the posterior angles; a series of long hairs on the posterior margin of each segment; transverse blotches of dark chestnut-brown continuous across the segments, with but a very narrow, pale, posterior marginal line; the lateral marginal bands are wide and distinctly darker brown, and they do not reach the posterior margins; the last segment broadly emarginate, with two long, dorsal hairs on the rounded, posterior angles, and two very short spines on the inner margin of the emargination; the ventral surface with dark transverse bands and a series of hairs along the posterior margin of each segment.

Menopon paululum n. sp. (Plate VIII, fig. 2).

Specimens from three out of thirty-four individuals shot of the Black-bodied Shearwater, *Puffinus opisthomelas*, from two out of fourteen shot of *Puffinus griseus*, and from two specimens out of six shot of *Puffinus creatopus*. The first *Menopon* species recorded from *Puffinus*. The new species shows no special resemblance to forms taken from allied birds, like Fulmars.

Description of the male. Body, length 1.13 mm., width .5 mm.; small, pale yellow with distinct brown ocular blotches; abdomen with golden transverse bands and brown marginal blotches.

Head, length .26 mm., width .38 mm.; front rounding, with four short hairs on the margin, one marginal hair at the suture, three long and one short hair in front of the ocular emargination which is distinct but shallow, with an ocular fringe; maxillary palpi long, last two segments extending beyond the margin of the head; eyes inconspicuous but with a distinct ocular fleck; temples but little expanded, with four long hairs and several short spines on the angles; occipital margin but slightly concave; head pale yellow with a brown

spot just outside the mandibles connected with them by a narrow brown band; mandibles dark, showing through the head; ocular blotches small, narrowing posteriorly; occipital margin with a narrow brown band and small occipital blotches.

Prothorax with anterior angles slightly produced, a short prickle and a long hair in the angle, a series of long hairs on the rounding posterior margin; transverse and longitudinal chitin bars pale yet distinct; no blotches. Metathorax with slight lateral emargination; posterior margin nearly straight, with a series of spiny hairs; a pale golden, narrow, mesothoracic, transverse band, and similarly colored, wider, metathoracic bands. Legs pale golden; femora thick. A median prosternal blotch, shield-shaped, with a lateral process projecting backward and outward; metasternum with a pale median blotch from which short spiny hairs arise.

Abdomen elliptical, with posterior angles of the segments slightly produced, a few short spines on the lateral margins, and one or two long hairs and short spines in the posterior angles; a series of stiff hairs along the posterior margin of the segments, those on the last segments being longer; on the ventral surface two transverse series of short spiny hairs on each segment; pale golden transverse bands extending across the segments to shiny brown subcircular marginal blotches; last segment rounding behind, without marginal blotches, and with a few longish hairs.

Female. Body, length 1.74 mm., width .67 mm.; head, length .27 mm., width .45 mm., thus being much longer than the male; transverse bands of the abdomen rather more distinct than in the male, the uncolored sutural bands being thus made also more distinct, each segment with posterior series of hairs; last segment with six stiff hairs on each rounding angular portion of the posterior margin, and the median straight portion with an uncolored border and fringe of fine hairs.

Menopon potulans n. sp. (Plate VIII, fig. 3).

One specimen from a Black-bodied Shearwater, *Puffinus griseus* (Bay of Monterey, California). Shorter, broader, and darker colored than *paululum* n. sp. from *Puffinus opisthomelas* (same locality).

Description of male. Body, length 1.34 mm., width .68 mm.; short, broadly elliptical; head with distinct ocular emargination and projecting temples; general color dark fuscous with distinct, large black ocular blotches; transverse abdominal bands fading in their medial portions but distinct laterally.

Head, length .28 mm., width .53 mm.; front rounded, with a very slight median angulation; a rather long median hair each side of the front angulation; a short marginal prickle in front of the suture, one rather long marginal hair just back of the suture; two pustulated hairs and one long spine in front of a distinct ocular emargination; eye distinct, filling base of ocular emargination with a black ocular fleck; temples rounding, projecting, with three long hairs and several spines; occipital margin concave, with six long hairs and two spines on the margin; front of the head with slightly darker brown triangular blotches each side of the pale front; mandibles showing through the head as a dark brown spot; ocular blotch broad and distinctly black, fading gradually along the temporal margin; occipital bands faintly showing; occipital blotches distinct, being connected by a narrow black band which fades on the temporal margins.

Prothorax with lateral angles narrowly rounding, with one long hair and a short spine, a series of long hairs on the rounding posterior margin; lateral blotches but little darker on the margins; transverse chitin bar distinct, but little darker than the fuscous ground color of the prothorax. Metathorax short, lateral margins slightly divergent, a little concave, a short prickle near the posterior angles and a long hair and one short spine in the angle; a series of hairs along the weakly convex posterior margin; lateral blotches distinct, meeting on the median line; darker brown to black on the lateral margins, a pale band on the posterior margin. Legs robust, pale fuscous with darker marginal markings. Sternal markings consisting of a distinct median blotch, with rounded anterior margins, posterior angles projecting backward, posterior margin also produced into a distinct angle.

Abdomen broadly elliptical, segments with short spines on the lateral margins and a few long hairs in the posterior angles; a series of dorsal, spiny hairs on the posterior margin of each segment; general color of the abdomen dark fuscous; lateral blotches distinct, black on the lateral margins, paler and fading out medially on the segments before segment 7; segments 7 and 8 with continuous transverse bands; segment 9 wide, with two lateral blotches meeting narrowly on the median line and a paler band on the lateral margin; the last segment flatly rounding; two short hairs on the posterior margin; ventral markings very similar to those of the dorsal surface, also a similar series of hairs on the posterior margins of the segments.

Menopon titan Piaget. (See Kellogg, New Mallophaga, I, 1896, p. 163, pl. xv, fig. 2).

One male from a Brandt's Cormorant, *Phalacrocorax penicillatus* (Bay of Monterey, California). This specimen differs from every other individual of this curious species that I have yet examined. It is smaller than var. *linearis*, the blotches of thorax are different, and the incomplete series of pustulated hairs along the posterior margins of the abdominal cross-bands conspicuously differ from the usual condition in *titan*. *Titan* has not before been taken from any other bird than a pelican, and this single individual from a cormorant may be a straggler. If so, it must have come from *Pelecanus californicus*, the only species of pelican found in the Bay of Monterey.

Var. *incompositum* Kellogg and Chapman. (Plate VIII, figs. 4 and 5). Male, body, length 4.6 mm., width 1.66 mm.; head, length .62 mm., width 1. mm.; the smallest variety of *titan* yet noted; mesothorax with a narrow transverse blackish band continuous across the segment; metathorax with triangular, blackish, lateral blotches, apex projecting inward; abdominal segments 1–8 with continuous, blackish, transversal bands, paler on segments 7 and 8; an incomplete series of pustules (six complete and prominent on segments 3–6) along posterior margin of each transverse band; last segment with a small transversal linear blotch on each side; genital blotch on underside of segment 8 composed of two lateral triangles partly overlapping a central shield, from which projects anteriorly a sharp, distinct, linear process; laterad of this central compound blotch there is on each side a weakly curving, blackish, diagonal, linear blotch. Found on Brandt's Cormorant, *Phalacrocorax penicillatus* (Bay of Monterey, California).

Menopon titan var. **linearis** Kellogg.

New Mallophaga, I, 1896, p. 163, pl. xv, fig. 2.

Many specimens from the Californian Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California). Described from the same host species, same locality.

Menopon funereum n. sp. (Plate VIII, fig. 6).

A single male from a Gairdner's Woodpecker, *Dryobates pubescens gairdnerii* (Sunol, California), and a pale male from a Western Evening Grosbeak, *Coccothraustes vespertinus montanus* (California). This second specimen determined with doubt. Not like *M. pici* Denny (Monograph. Anoplur. Brit., p. 219, pl. xx, fig. 5; Piaget, Supplement, p. 93, pl. x, fig. 3) from *Picus viridis;* also differing distinctly from *M. præcursor* Kellogg (Mallophaga from Birds of Panama, Baja California, and Alaska, in New Mallophaga, III, 1899, p. 46, pl. iv, fig. 8) from *Melanerpes uropygialis* (Baja California).

Description of the male. Body, length 1.5 mm., width .59 mm.; mostly dark colored because of the strong, continuous, brown, transverse, abdominal bands and the blackish marking of the head, thorax and legs; thorax long, with mesothoracic sutural line distinct under magnification.

Head, length .4 mm., width .56 mm.; front convex, with two marginal hairs near the median line of the front, a short prickle midway between this hair and a long hair and short spine which are on the angle in front of a slight lateral concavity, in which are a long hair and short prickle; a long hair and shorter hair near the posterior angle of the concavity and in front of the angle before the ocular emargination on which are two long hairs; eye large, filling the inner angle of the ocular emargination, distinctly emarginate and with a large black ocular fleck; a rather long hair on its dorsal surface near the margin; a distinct ocular fringe; temple meeting the ocular emargination angularly; fine, long, pustulated hairs and some short spines on the temporal margin; occipital margin concave, with two long hairs near the median line; ground color of the head pale fuscous with dark blackish brown blotches each side of the front; ocular blotches broad, distinct on the posterior margin but fading anteriorly till they color the angle in front of the ocular emargination; temples narrowly and irregularly bordered with dark brown; occipital margin with a defined blackish brown band, widening into angular occipital blotches; distinct occipital signature.

Prothorax short; anterior angles inconspicuous, with two spines; posterior margin with a series of long hairs; ground color dark fuscous, with distinct chitin bars. Mesothorax and metathorax long, being separated by a narrow, uncolored suture and slight lateral emargination, mesothorax dark on the anterior portion; metathorax with distinct dark chitin bars. Sternal markings consisting of dark intercoxal lines; prothorax with distinct median blotch of pale fuscous, a distinct V-shaped chitin bar longitudinally across it; dark median blotches on the meso- and metathorax. Legs large, pale fuscous with dark marginal borders and semiannulations; scattered hairs and spines.

Abdomen short, broadly elliptical, small as compared with the large head and thorax, which are together longer than the abdomen; a series of long hairs on the posterior margin of each segment and a few short spines and hairs in the posterior angles; each segment with a broad, dark, transverse band, darker on the lateral margin and covering almost all of the segment; a longitudinal, submarginal, pale band, parallel with the lateral margins of the abdomen; last segment broadly rounded, with several long hairs near the lateral margin and some shorter hairs on the posterior portion of the segment; ventral surface with at least one series of short pustulated hairs on the posterior margin of each segment; genitalia distinct, angular, extending far forward in the body.

Menopon distinctum n. sp. (Plate VIII, fig. 7).

Specimens from two specimens of the Ash-throated Flycatcher, *Myiarchus cinerascens* (Palo Alto and Ontario, California), and from a Cactus Wren, *Heleodytes brunneicapillus* (Ontario, California). A well marked form.

Description of the female. Body, length 1.5 mm. width .62 mm., elongate-ellipitical; pale translucent fuscous with blackish brown ocular blotches; black ocular fleck and small blackish spots on the lateral margins of the front; dark transverse blotches on the abdomen; a distinct pale submarginal longitudinal line parallel with the lateral margin of the abdomen.

Head, length .31 mm., width .46 mm.; parabolic, wide through the temples; front broadly rounding, a slight angulation in front; one hair each side of this angulation; two hairs on the lateral margin of the front; two long hairs on a slight swelling in front of a distinct ocular emargination; one long and two short hairs on the dorsal surface, in front of the ocular emargination; eye large, filling the angle of the emargination and extending on the temple, with a slight constriction; a short spine on the posterior portion, and a large black ocular fleck; ocular fringe made up of comparatively few stiff spines, more numerous on the outer margin in front of the temples; two long hairs and several shorter hairs on the temporal margin; occipital margin nearly straight, with two long and two short hairs; pale translucent fuscous; mandibles dark, showing through the front; a dark spot on the lateral margin of the front outside the base of the mandibles; ocular blotches dark brown to black, extending forward as far as the dark lateral blotches, but paler chestnut-brown anteriorly; dark narrow border on the occiput, occipital bands pale yet distinct.

Prothorax with convex lateral margins; a short spine in the anterior angle; a few spines on the lateral margin; a series of long hairs on the rounding posterior margin; fulvous, with dark transverse and longitudinal chitin bars distinct. Mesothorax wide, with strongly divergent sides; a few spines on the lateral margin; one long hair and several spines in the posterior angle; dark inner chitin bars extending along the anterior angle and back across the segment; a second chitin bar extending from the lateral margin back across the metathorax; the posterior angle of the mesothorax dark fuscous, otherwise the segment is pale translucent fuscous. Metathorax narrow; a long hair and a short spine in the posterior angles; dark lateral triangular blotches, fading inwardly. Legs long, pale translucent fuscous, with dark fuscous borders and semiannulations; many short spines on the femora. Sternal markings consisting of distinct brown intercoxal lines and a pale but distinct wedge-shaped median blotch.

Abdomen broadly elliptical; several spines on the lateral margins of the segments; some long hairs in the posterior angles; many dorsal spines, not arranged in any definite series on the segments; lateral marginal blotches dark fuscous, separated from the median transverse blotches by a pale submarginal band, parallel with the lateral margin of the abdomen; median transverse blotches paler fuscous; transverse bands of segments 1 to 6 widely separated by uncolored sutural bands; last segment rounding, with a fringe of hairs on the posterior margin, dark transverse blotch narrowed distinctly in the middle, ventral transverse bands distinctly fuscous; many hairs arranged nearly in two definite series in each segment.

Male. Body, length 1. mm., width .59 mm.; head, length .25 mm., width .5 mm.

Menopon persignatum n. sp. (Plate IX, fig. 1).

Many specimens from the California Jay, *Aphelocoma californica* (2 specimens, Mountain View, California). Resembling in general shape and characters the three or four species of *Menopon* described by Nitzsch and Piaget from the European Jays.

Description of the female. Body, length 2.03 mm., width .75 mm.; long, narrow; pale fuscous with distinct black ocular blotches, blackish lines in the thorax, and broad dark fuscous transverse abdominal bands.

Head, length .34 mm., width .56 mm,; front broadly but slightly angularly rounding; no hairs on the frontal margin, one long and two shorter hairs on the lateral margins of forehead, besides two long hairs just in front of the ocular emargination, which is nearly filled by the large eye which is slightly emarginated and bears a short prickle; ocular fringe with only a few hairs of uneven length; temples produced, rather narrowly rounded, with five long hairs and several short hairs and spines on the margin ; occipital margin straight in its middle portion ; one long and one short hair near the posterior margin, and one hair on each side of the median line; ground color of the head fuscous with distinct, curving, linear blackish ocular blotches; an indistinct brown occipital signature with anterior angles produced laterally.

Prothorax large, lateral angles with one long hair and a short spine, two long hairs in the broadly rounded posterior angle and a series of six long hairs on the straight posterior margin. Mesothorax with four or five short spines on the lateral margin and two long hairs and two spines in the posterior angle; a series of stiff hairs along the posterior margin. Metathorax with a series of stiff hairs on its posterior margin, and in the posterior angle one long hair and two spines; ground color of the thorax is pale fuscous, no distinct blotches, but dark transverse and longitudinal chitin bars on the prothorax; curving chitin bars on the anterior angle of the mesothorax, and a pair of chitin bars extending from the anterior half of the lateral margin of the mesothorax back across the metathorax as far as the third pair of coxæ. Sternal markings consisting of dark intercoxal lines; on the prothorax a small median blotch with the posterior angles extended in dark chitin bars which extend forward to the anterior margin; the posterior margin of the blotch extends back in a narrow point; a large wedge-shaped blotch between the second and third pair of coxæ; this blotch has a series of short pustulated hairs on its anterior and lateral margins. Legs pale fuscous with narrow dark borders.

Abdomen elongate-elliptical; two long hairs and short spines in the posterior angles; a series of short hairs on the posterior margin of each segment, growing more stiff and spine-like near the lateral margin; broad dark fuscous transverse bands separated by broad pale sutural bands; darkening laterally to form broad dark lateral bands, set off by rather broad pale submarginal, longitudinal bands; last segment flatly rounding, with a fringe of fine hairs; ventral surface with similar markings, but with an irregular median transverse series of hairs, besides the series on the posterior margin of the segment.

Male. Body, length 1.43 mm., width .75 mm.; head, length .28 mm., width .56 mm., thus being much smaller than the female; also of short, broad, oval shape rather than elongate and narrow; darker and more evenly fuscous; pale submarginal longitudinal bands parallel with the sides of the abdomen less distinct than in female; transverse bands narrow and less definite; lateral blotches narrow and darker on the posterior margin of the segments; last segment slightly angular, with a fringe of hairs; genitalia faintly distinguishable through the body, extending forward into segment 7.

Menopon incertum Kellogg.

New Mallophaga, II, 1896, p. 533, pl. lxxiii, fig. 2.

Many specimens from a Russet-backed Thrush, *Turdus ustulatus* (Palo Alto, California); a Western Lark Sparrow, *Chondestes grammacus strigatus* (Ontario, California); and a Vigor's Wren, *Thryothorus bewickii spilurus* (Palo Alto, California). Taken previously by Kellogg from *Turdus ustulatus* and from the American Goldfinch, *Spinus tristis* (same locality).

Menopon mæstum n. sp. (Plate IX, fig. 2).

Two specimens from a Golden-crowned Sparrow, *Zonotrichia coronata* (Palo Alto, California), and a

Samuel's Song Sparrow, *Melospiza fasciata samuelis* (Palo Alto, California). A short, broad species, with short, wide head, and wide prothorax, approaching the *Eureum* type of Menopon (see p. 133 this paper).

Description. Body, length 1.37 mm.; width .81 mm.; short, broad; head very short and wide, not of the usual evenly crescentic type; occipital margin straight and dark; general color dark fuscous, the dark markings of the head making the posterior portion appear quadrangular.

Head, length .28 mm., width .59 mm.; front broad, flatly rounded; six hairs on the front, one each side of the angulation and three (one long and two shorter) hairs on the lateral margins of the front; two hairs on the angle in front of the ocular emargination; lateral margin of the forehead almost at right angles with the lateral margins of the front; eye large, prominent, with a large black ocular fleck and a short spine; ocular fringe sparsely spined; temples projecting strongly, and narrowly convex, with three long hairs and several shorter hairs and spines; occipital margin straight; a narrow broad submarginal band across the front, its posterior ends bending in so as to leave clear pale brown the anterior portion of the angle in front of the ocular emargination; from this angle a distinct dark fuscous quadrangular blotch extends back to the occipital margin, cutting off the rounding temples which are very pale fuscous; ocular blotches narrow and dark, extending forward along the ocular emargination, meeting the anterior margin of the dark fuscous blotch interrupting the arms of the narrow uncolored V-shaped marking, which has its branches rising from the inner angle of the ocular emargination and its vertex on the occipital margin; occipital blotches blackish brown, connected by a narrow even line on the occipital margin; a dark broad occipital signature showing through the head.

Prothorax short and wide; two short spines in the anterior margin and a series of four long pustulated hairs and one short spine on each rounding lateral and posterior margin; transverse and longitudinal chitin bars distinct; median portion of the prothorax pale anteriorly, but darker fuscous towards the posterior margin; lateral portions, beyond the longitudinal chitin bars, dark fuscous. Mesothorax narrow; posterior angles distinctly angular, with a long hair and spine; dark transverse band on the posterior margin, dark longitudinal chitin bars extending from the anterior angles across the mesothorax; a second pair of chitin bars extending from the anterior, lateral margins back across the metathorax. Metathorax narrow, appearing like the first abdominal segment; a long hair and two spines in the posterior angle; a dark brown transverse band across the lateral margin. Sternal markings consisting of dark intercoxal lines, a median blotch on the prothorax, with the posterior angles produced laterally, meeting narrow dark chitin bars which extend forward to the anterior margin; the posterior margin of the blotch also produced in an angle; a broad brown median band between the second and third pair of legs, also extending onto the first abdominal segments; a few scattered pustulated hairs on this band. Legs large, pale fuscous, with narrow dark borders and scattered hairs.

Abdomen broadly ovate, the poles broadly truncate; posterior angles projecting, with one or two long hairs and a short spine; segments narrower on the anterior half of the abdomen; a few hairs on the posterior margin of the segments; entire abdomen a dark rich fuscous, darker on the posterior margins of the segments; last segment broad, narrow, with a fringe of hairs along the rounding posterior margin.

Menopon malleus Nitzsch (Plate IX, fig. 3).

Germar's Mag. Ent., 1818, vol. iii, p. 301.

Eureum malleus Nitzsch, Burmeister, Handb. d. Ent., 1840, vol. ii, p. 441; Denny, Monograph. Anoplur. Brit., 1842, p. 288; Giebel, Insecta Epizoa, 1874, p. 249; Piaget, Les Pediculines, 1880, p. 608, Supplement, 1885, p. 139, pl. xv, fig. 3.

A single immature specimen from a Cliff Swallow, *Petrochelidon lunifrons* (Ontario, California), and an adult female and an immature specimen from a Cactus Wren, *Heleodytes brunneicapillus* (Ontario, California). The single specimen of this species previously known was collected by Nitzsch in 1814 from *Hirundo rustica*. As the above named Cliff Swallow and Cactus Wren were collected by the same person on the same day *it may be* that the two individuals taken from the wren are stragglers from the swallow.

This species has heretofore been attributed to the genus *Eureum* Nitzsch, the genus being based upon the single specimen (which, though heretofore apparently not so considered, is immature) of this species and a very few specimens of another very different species, *cimicoides* Nitzsch from the European Swift *Cypselus apus*. Piaget has suspected that both these species are merely rather aberrant members of the genus *Menopon*, which position, as regards the species *malleus*, at least, we take unqualifiedly. The two species have been held together partly through the usual conception of the near relationship of the hosts; as Nitzsch says, "*habitatio in chelidonum familia*" (Germar's Mag. Ent., vol. iii, p. 301, 1818). Now, in fact, the swallows and the swifts are not nearly related at all, the swifts finding their near relations among the night-hawks and hummingbirds. The finding of an immature and an adult female together on the wren, in addition to a single immature specimen on the swallow, allows us to present new evidence of the agreement of the species in generic characters with *Menopon*. The *Menopon* species, *mœstum*, described in this paper, serves as an easy step from the more typical *Menopon* type to this peculiar *Eureum* type with its short, broad head, its short, broad prothorax, and long, heavy legs. *Menopon robustum* Kellogg (New Mallophaga, II, 1896, p. 528, pl. lxxii, fig. 3) is of this gradatory type, and presents "a mingling of characters of *Menopon*, *Ancistrona*, and *Eureum;* a short, broad head with strongly chitinized, backward-projecting processes on the ventral surface like *Ancistrona;* a thorax like *Eureum;* and the habitus and general body characters of *Menopon*" (Kellogg, l. c.). Osborn's *M. expansum* (Insects Affecting Domestic Animals, U. S. Dept. Ag., Div. Ent., Bull. N. S., No. 5, 1896, p. 245, pl. ii, fig. *j*.) from *Dolichonyx oryzivorus* must also be of this general type.

Our immature forms correspond with the description and figure (Piaget, Supplement, p. 139, pl. xv, fig. 3) of the species. Our adult female (figured herewith) shows the following characters not referred to, or unconformable to those in Piaget's description. Body, length 2.25 mm., width 1.15 mm.; head, length .34 mm., width .9 mm.; head less flatly rounded in front than in the young, and with a slight median angulation; on each side of this angulation a conspicuous marginal hair, and farther to the side a longer hair not marginal, but rising from just in front of the base of the antenna. Metathorax with two long hairs and three spines in the posterior angles, the three spines ranged along the posterior margin. Dorsal surface of the abdomen with a few scattered, longish hairs; ventral surface with groups of short, strong spines and some longish hairs on the lateral part of the posterior margins of segments; last segment broadly rounded behind, with fringe of weak hairs of different lengths.

Menopon ridulosum n. sp. (Plate IX, fig. 4).

Specimens from two Yellow Warblers, *Dendroica æstiva* (Palo Alto, California). A small, heavy-bodied form.

Description. Body, length 1. mm., width .53 mm.; being thus a very small species; head large compared with the rest of the body; head almost as wide as long; abdomen with narrow transverse abdominal bands.

Head, length .46 mm., width .51 mm.; large, nearly as broad as the abdomen; front broadly parabolic, with a slight median angulation; two short hairs in front each side of the angle, several shorter hairs in the frontal margin, two longer hairs on the lateral margin, and two long hairs on the angle before the shallow ocular emargination; eye with a black ocular fleck; ocular fringe distinct; two very long hairs on the narrowly rounding temples and several short spines; occipital margin concave, with four long hairs on the margin; two small angular blackish spots on the lateral margin of the front outside the mandibles, which are also dark, showing through the head; ocular blotches curving, blackish brown, fading on the anterior portion of the ocular emargination; a narrow band of dark blackish brown on the occipital margin.

Prothorax wide; a long hair and short spine on the anterior angle; a series of long hairs on the rounding posterior margin; dark transverse and longitudinal chitin bars distinct, dark brown, while the ground color of the prothorax is even pale fulvous. Mesothorax long, with strongly diverging sides; posterior angles sharp, with several long hairs and broad heavy spines; a series of hairs on the posterior margin; ground color pale fulvous with distinct, narrow chitin bars extending from the anterior angles across the mesothorax, a second pair of chitin bars extending from the lateral margins across the meso- and metathorax. Metathorax narrow; posterior angles with a few long hairs and heavy spines; posterior margin with a series of hairs; intercoxal lines showing through the thorax. Legs pale fulvous with darker marginal markings.

Abdomen broadly elliptical, short; posterior angles with one or two long hairs and some heavy spines; a series of hairs on the posterior margin of the segments, which give place to heavy spines near the lateral margin; a few scattered dorsal spines; last segment flatly rounded, with a few short marginal spines; narrow dark fuscous transverse bands, separated by broad pale transverse bands.

Physostomum.

We have representatives of this genus from a dozen species of passerine birds, but we do not feel able to make satisfactory specific determination of our material except in a few instances. We do not believe that under the present knowledge of the group much can be done toward distinguishing any but peculiar and obviously characterized species, forms readily separable by marked peculiarity of shape. We have specimens of this genus from the following birds, all from California: Western Wood Pewee, *Contopus richardsonii* (two specimens); Say's Phœbe, *Sayornis saya*; Western

Flycatcher, *Empidonax difficilis*; Ash-throated Flycatcher, *Myiarchus cinerascens*; Spurred Towhee, *Pipilo maculatus megalonyx*; California Towhee, *Pipilo fuscus crissalis*; Cedar Waxwing, *Ampelis cedrorum*; Samuel's Song Sparrow, *Melospiza fasciata samuelis*; Least Vireo, *Vireo bellii pusillus*. In addition, we distinguish the three following species of the genus.

Physostomum sucinaceum Kellogg.

New Mallophaga, II, 1896, p. 514, pl. lxx, fig. 2.

Three specimens from a Western Flycatcher, *Empidonax difficilis* (Palo Alto, California). Previously taken by Kellogg from the same host (same locality).

Physostomum diffusum Kellogg.

New Mallophaga, II, 1896, p. 518, pl. lxx, fig. 3.

One specimen, var. *pallidum* Kellogg from an Oregon Junco, *Junco hyemalis oregonus* (Pullman, Washington). Taken previously by Kellogg from *Junco* sp. (Lawrence, Kansas).

Physostomum prominens n. sp. (Plate IX, fig. 5).

Two specimens from a Costa's Hummingbird, *Calypte costæ* (Ontario, California). This strange form with its lateral head margins deeply sinuate and its unique prothorax is very different from any other *Physostomum* described. The specimens are probably not fully mature, one distinctly immature, the other lacking probably only coloration intensity.

Description. Body, length 2 mm., width .85 mm.; transparent whitish; head short and broad, with deeply sinuous lateral margins; eyes in the posterior angles.

Head, length .5 mm., width .53 mm.; broad, short; front broad, straight; conspicuous projecting lateral palettes; the lateral margins of the head deeply concave before the middle; temples swollen, the margins convex; head widest across the posterior angles which are not produced backwards, but rounding rectangular; the inconspicuous eyes with conspicuous black flecks are situated in the very apex of these angles; each angle bears two longish hairs and one shorter one; posterior margin nearly straight, feebly angulated in the middle; whole head transparent whitish with faint brownish tinge here and there.

Prothorax large, lateral margins with lateral angles broadly and bluntly rounded; posterior margin almost semicircular, with four rather short hairs on each lateral half; pale transparent whitish with faint brownish at margins. Metathorax with rapidly diverging lateral margins, straight posterior margin with two hairs and a spine in region of posterior angles, three hairs near posterior margin just inside of this region, and two hairs and a spine anterior to these submarginal hairs.

Abdomen broadly elliptical; posterior angles not projecting and without conspicuous hairs; on the lateral portion of each segment a group of three hairs near the posterior margin, and a hair and a spine near the lateral margin and more anterior; pale transparent whitish with a pale brown narrow submarginal longitudinal band fading posteriorly.

LIST OF HOSTS WITH PARASITES.

- Æchmophorus occidentalis.
  - Menopon tridens.
- Colymbus nigricollis californicus.
  - Nirmus fusco-marginatus var. americanus.
  - Menopon tridens.
- Lunda cirrhata.
  - Nirmus pacificus.
  - Colpocephalum perplanum.
- Cerorhinca monocerata.
  - Nirmus maritimus.
- Ptychoramphus aleuticus.
  - Nirmus maritimus.
- Synthliboramphus antiquus.
  - Nirmus maritimus.
- Cepphus columba.
  - Docophorus procax.
  - Nirmus pacificus.
    - fusco-marginatus var. americanus.
- Stercorarius pomarinus.
  - Docophorus melanocephalus.
  - Nirmus triangulatus.
  - Lipeurus laculatus.
- Rissa tridactyla pollicaris.
  - Nirmus lineolatus var. atrimarginatus.
- Larus occidentalis.
  - Docophorus lari.
- Larus argentatus smithsonianus.
  - Nirmus fusco-marginatus var. americanus.
- Larus vegæ.
  - Nirmus lineolatus var. atrimarginatus.
- Larus delewarensis.
  - Docophorus lari.
  - Nirmus punctatus.
  - Menopon infrequens.
- Larus brachyrhynchus.
  - Nirmus lineolatus var. atrimarginatus.
- Larus canus.
  - Nirmus lineolatus var. atrimarginatus.
- Larus heermanni.
  - Docophorus lari.
  - Colpocephalum funebre.
- Sterna maxima.
  - Docophorus melanocephalus.
- Diomedea albatrus.
  - Nirmus giganticola.
  - Lipeurus diversus.
    - densus.
    - concinnus.
    - ferox.
  - Giebelia mirabilis.
  - Eurymetopus taurus.
  - Colpocephalum pingue.
  - Menopon irrumpens.
- Fulmarus glacialis glupischa
  - Nirmus maritimus.
- Puffinus creatopus.
  - Lipeurus diversus.
    - testaceous.
    - fuliginosus var. major.
    - laculatus.
  - Giebelia mirabilis.
  - Menopon paululum.
- Puffinus opisthomelas.
  - Docophorus validus.
  - Lipeurus diversus
    - testaceous.
    - limitatus.
    - fuliginosus var. major.
  - Ancistrona gigas.
  - Giebelia mirabilis.
  - Menopon paululum.

- Puffinus griseus.
  - Nirmus giganticola.
    - pacificus.
  - Lipeurus diversus.
    - limitatus.
  - Giebelia mirabilis.
  - Ancistrona gigas.
  - Menopon paululum.
    - petulans.

- Puffinus tenuirostris.
  - Lipeurus diversus.
    - limitatus.
  - Giebelia mirabilis.
- Puffinus bulleri.
  - Lipeurus diversus.
    - limitatus.
  - Giebelia mirabilis
- Phalacrocorax penicillatus.
  - Lipeurus farallonii.
  - Menopon titan var. incompositum.
- Pelecanus californicus.
  - Lipeurus forficulatus.
  - Menopon titan var. linearis.
- Anas americana.
  - Trinoton luridum.
- Spatula clypeata.
  - Lipeurus squalidus.
  - Trinoton lituratum.
    - luridum.
- Aythya marila nearctica.
  - Docophorus icterodes.
  - Trinoton luridum.
- Aythya affinis.
  - Docophorus icterodes.
- Rallus obsoletus.
  - Oncophorus bisetosus var. californicus.
  - Menopon tridens.
- Rallus virginianus.
  - Oncophorus bisetosus var. californicus.
  - Menopon tridens.
- Tringa minutilla.
  - Docophorus fusiformis.
  - Nirmus complexivus.
- Calidris arenaria.
  - Nirmus actophilus.
    - complexivus.
  - Colpocephalum spinulosum var. minor.
- Limosa fedoa.
  - Nirmus cordatus.
- Squatarola squatarola.
  - Docophorus fuliginosus.
  - Nirmus incœnis.
  - Colpocephalum timidum.
- Ægialitis semipalmata.
  - Docophorus fuliginosus.
  - Nirmus opacus.
- Oreortyx pictus plumiferus.
  - Lipeurus docophoroides var. californicus.
- Dendragapus obscurus fuliginosus.
  - Lipeurus perplexus.
- Pediocætes phasianellus columbianus.
  - Lipeurus perplexus.
  - Goniodes mammillatus.
- Elanus leucurus.
  - Nirmus fuscus.
- Accipiter atricapillus striatulus.
  - Nirmus fuscus.
- Buteo borealis calurus.
  - Nirmus fuscus.
- Aquila chrysaëtos.
  - Docophorus pictus.
  - Colpocephalum flavescens.
- Haliæetus pelagicus.
  - Colpocephalum flavescens.
- Falco sparverius deserticolus.
  - Nirmus fuscus.
- Asio wilsonianus.
  - Docophorus cursor.
- Syrnium nebulosum.
  - Docophorus speotyti.
- Scotiaptex cinerea.
  - Oncophorus remotus.
- Nyctea nyctea.
  - Docophorus ceblebrachys.
- Dryobates pubescens gairdnerii.
  - Menopon funereum.
- Dryobates nuttallii.
  - Docophorus singularis.
- Xenopicus albolarvatus.
  - Docophorus californiensis.
- Sphyrapicus thyroideus.
  - Docophorus californiensis.

Melanerpes formicivorus bairdi.
Docophorus californiensis.
Trochilus alexandri.
Nirmus vulgatus.
Calypte costæ.
Physostomum prominens.
Tyrannus verticalis.
Nirmus fœdus.
Myiarchus cinerascens.
Docophorus communis.
rufus.
fusco-ventralis.
Nirmus vulgatus.
fœdus.
Physostomum sp.
Menopon distinctum.
Sayornis saya.
Nirmus fœdus.
Physostomum sp.
Contopus richardsonii.
Physostomum sp.
Empidonax difficilis.
Docophorus communis.
Nirmus vulgatus.
ductilis.
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Menopona persignatum.
Sturnella magna neglecta.
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Scolecophagus cyanocephalus.
Docophorus communis.
Coccothraustes vespertinus montanus.
Menopon funereum.
Carpodacus mexicanus frontalis.
Nirmus vulgatus.
Spinus pinus.
Docophorus communis.
Chondestes grammacus strigatus.
Docophorus communis.
Nirmus vulgatus.
Menopon incertum.
Zonotrichia leucophrys intermedia.
Docophorus communis.
Zonotrichia leucophrys gambelii.
Docophorus communis.
Zonotrichia coronata.
Docophorus communis.
Nirmus vulgatus.
Menopon mæstum.
Spizella sp.
Docophorus communis.
Spizella socialis arizonæ.
Docophorus communis.
Junco hyemalis oregonus.
Physostomum diffusum.
Junco hyemalis thurberi.
Docophorus mirinotatus.
Amphispiza belli.
Docophorus communis.
Nirmus lautiusculus.
Melospiza fasciata heermanni.
Colpocephalum grandiculum.
Melospiza fasciata samuelis.
Docophorus communis.
Physostomum sp.
Menopon mæstum.
Pipilo maculatus megalonyx.
Nirmus vulgatus.
Physostomum sp.
Pipilo fuscus crissalis.
Docophorus communis.
Nirmus vulgatus.
Colpocephalum grandiculum.
Physostomum sp.
Zamelodia melanocephala.
Docophorus communis.
Guiraca cærulea eurhyncha.
Docophorus communis.
Nirmus vulgatus.

- Passerina amœna.
  - Nirmus vulgatus..
- Piranga ludoviciana.
  - Docophorus communis.
- Petrochelidon lunifrons.
  - Menopon malleus.
- Chelidon erythrogastra.
  - Nirmus longus var. domesticus.
- Ampelis cedrorum.
  - Docophorus communis.
  - Nirmus brachythorax.
  - Physostomum sp.
- Phainopepla nitens.
  - Nirmus fœdus.
- Lanius borealis.
  - Docophorus communis.
- Lanius ludovicianus gambeli.
  - Docophorus communis.
  - Nirmus fœdus.
- Vireo solitarius plumbeus.
  - Docophorus communis.
- Vireo bellii pusillus.
  - Physostomum sp.
- Helminthophila celata lutescens.
  - Nirmus vulgatus.
- Dendroica æstiva.
  - Docophorus communis.
- Dendroica æstiva.
  - Nirmus vulgatus.
  - Menopon ridulosum.
- Icteria virens longicauda.
  - Nirmus fœdus.
- Cinclus mexicanus.
  - Nirmus vulgatus.
- Heleodytes brunneicapillus.
  - Menopon malleus.
    - distinctum.
- Thryothorus bewickii spilurus.
  - Docophorus communis.
    - mirus.
  - Menopon incertum.
- Parus inornatus.
  - Docophorus communis.
- Parus gambeli.
  - Nirmus vulgatus.
- Parus rufescens neglectus.
  - Nirmus vulgatus.
- Turdus ustulatus.
  - Menopon incertum.
- Turdus aonalaschkæ auduboni.
  - Docophorus communis.
- Sialia mexicana occidentalis.
  - Docophorus communis.
  - Nirmus vulgatus.

EXPLANATION OF PLATES.

PLATE V.—Fig. 1, *Docophorus procax* Kellogg and Chapman, ♀. Fig. 2, *D. validus* Kellogg and Chapman, ♀. Fig. 3, *D. fusiformis* Denny, ♂. Fig. 4, *D. pictus* Giebel, ♀. Fig. 5, *D. singularis* Kellogg and Chapman, ♀. Fig. 6, *D. mirinotatus* Kellogg and Chapman, ♀. Fig. 7, *D. mirus* Kellogg and Chapman, ♀. Fig. 8, *Nirmus pacificus* Kellogg and Chapman, ♀. Fig. 9, *N. fusco-marginatus* Denny, var. *americanus* Kellogg and Chapman, ♀.

PLATE VI.—Fig. 1, *Nirmus maritimus* Kellogg and Chapman, ♀. Fig. 2, *N. triangulatus* Nitzsch, ♀. Fig. 3, *N. complexivus* Kellogg and Chapman, ♀. Fig. 4, *N. actophilus* Kellogg and Chapman, ♀. Fig. 5, *N. incænis* Kellogg and Chapman, ♀. Fig. 6, *N. opacus* Kellogg and Chapman, ♀. Fig. 7, *N. fœdus* Kellogg and Chapman, ♀. Fig. 8, *N. ductilis* Kellogg and Chapman, ♀. Fig. 9, *N. lautiusculus* Kellogg and Chapman, ♂.

PLATE VII.—Fig. 1, *Lipeurus laculatus* Kellogg and Chapman, ♂. Fig. 2, *L. concinnus* Kellogg and Chapman, ♂. Fig. 3, *L. fuliginosus* Taschenberg, var. *major* Kellogg and Chapman, ♂. Fig. 4, *L. faralloni* Kellogg, ♂. Fig. 5, *L. perplexus* Kellogg and Chapman, ♀. Fig. 6, *Oncophorus bisetosus* Piaget, var. *californicus* Kellogg and Chapman, ♀. Fig. 7, *O. remotus* Kellogg and Chapman, ♂. Fig. 8, *Colpocephalum perplanum* Kellogg and Chapman, ♀. Fig. 9, *C. spinulosum* Piaget, var. *minor* Kellogg and Chapman, ♂. Fig. 10, *C. grandiculum* Kellogg and Chapman, ♀.

PLATE VIII.—Fig. 1, *Menopon irrumpens* Kellogg and Chapman, ♀. Fig. 2, *M. paululum* Kellogg and Chapman, ♀. Fig. 3, *M. petulans* Kellogg and Chapman, ♂. Fig. 4, *M. titan* Piaget, var. *incompositum* Kellogg and Chapman, dorsal aspect of one abdominal segment. Fig. 5, *M. titan* Piaget, var. *incompositum* Kellogg and Chapman, ventral aspect of last segments of abdomen of ♂. Fig. 6, *M, funereum* Kellogg and Chapman, ♂. Fig. 7, *M. distinctum* Kellogg and Chapman, ♀.

PLATE IX.— Fig. 1, *Menopon persignatum* Kellogg and Chapman, ♀. Fig. 2, *M. mæstum* Kellogg and Chapman, ♀. Fig. 3, *M. malleus* Nitzsch, ♀. Fig. 4, *M. ridulosum* Kellogg and Chapman, ♀. Fig. 5, *Physostomum prominens* Kellogg and Chapman.

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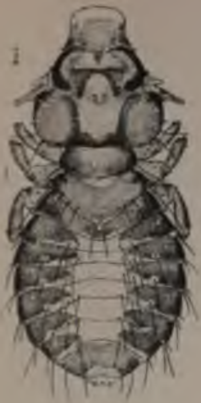

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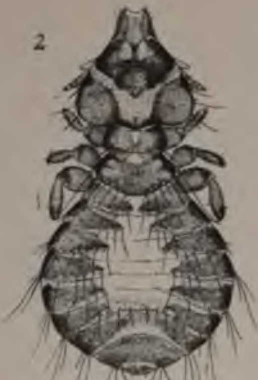

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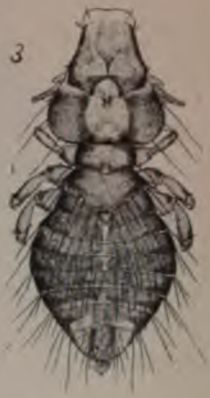

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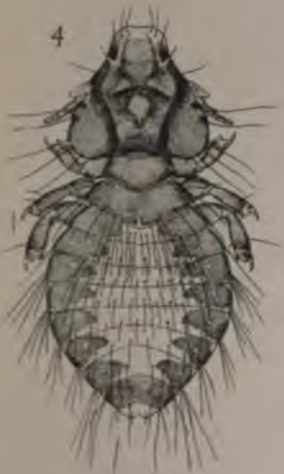

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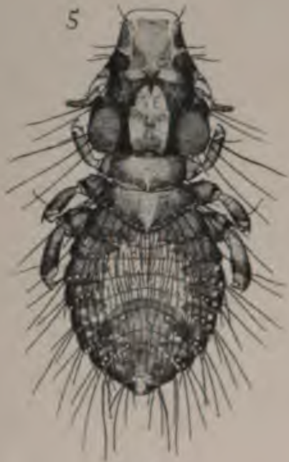

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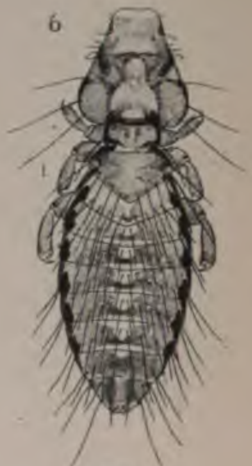

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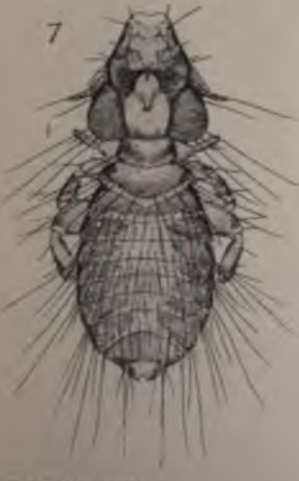

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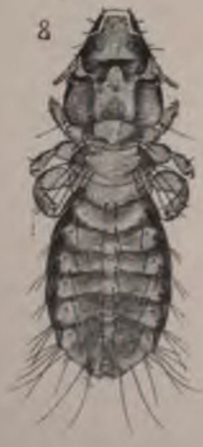

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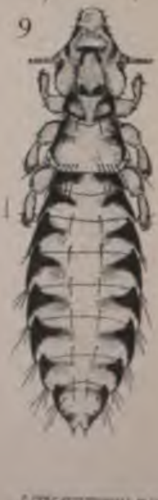

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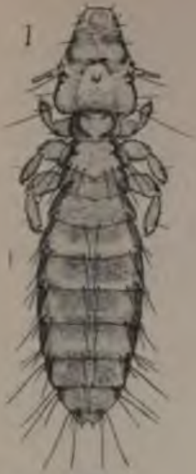

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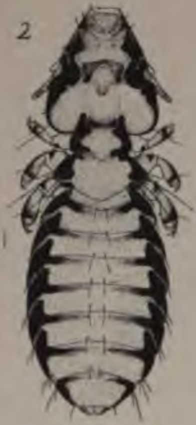

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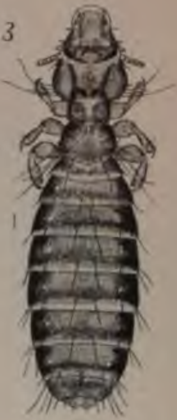

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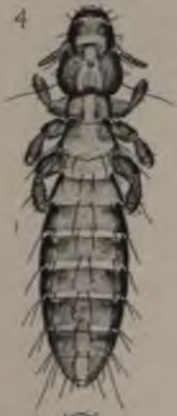

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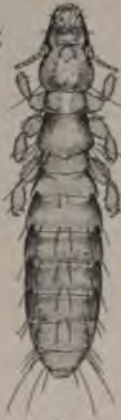

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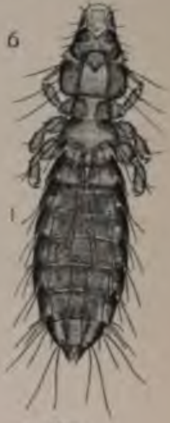

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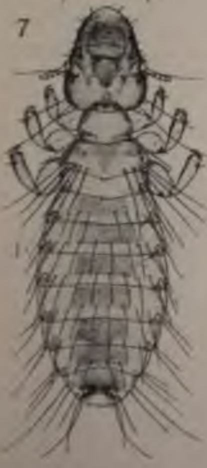

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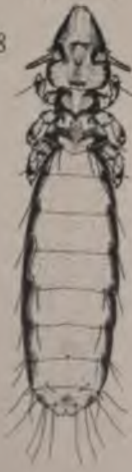

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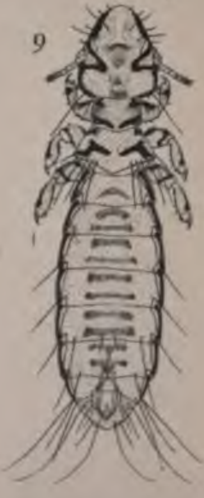

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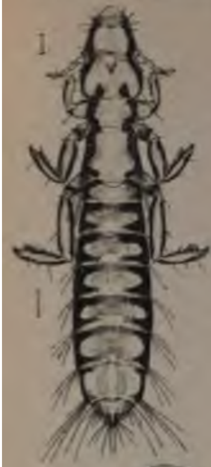

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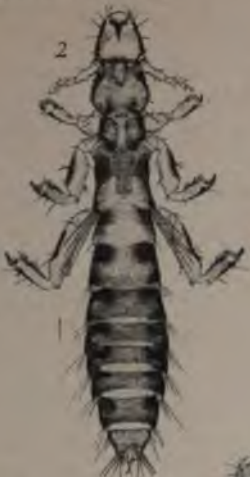

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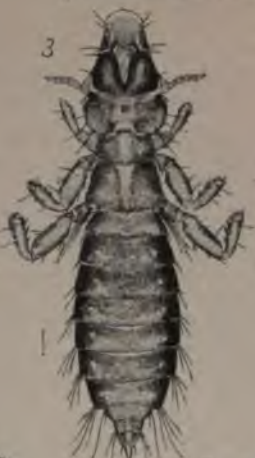

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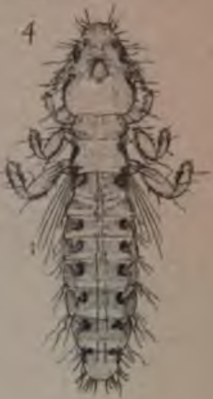

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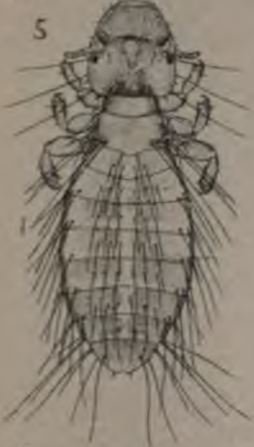

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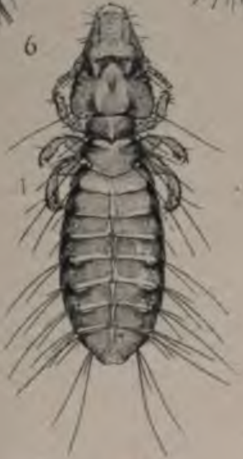

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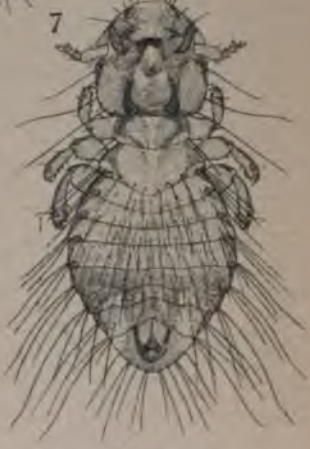

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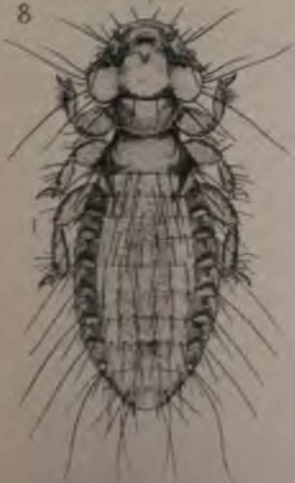

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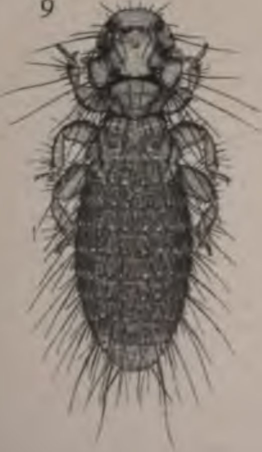

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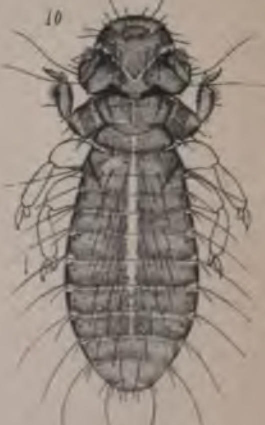

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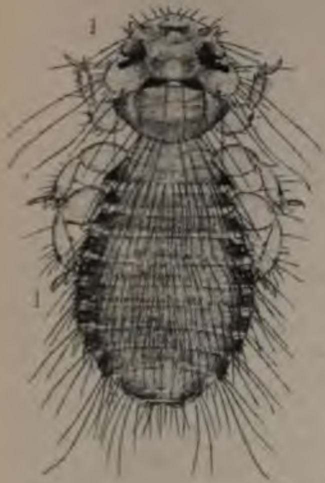

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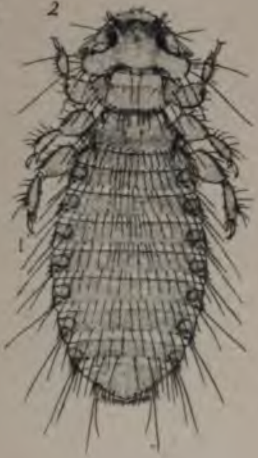

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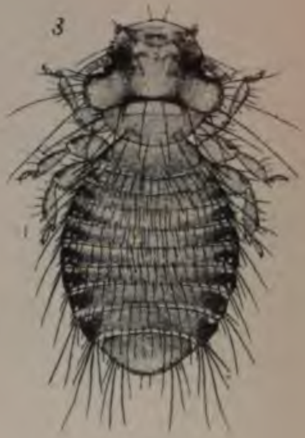

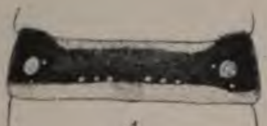

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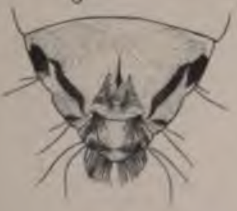

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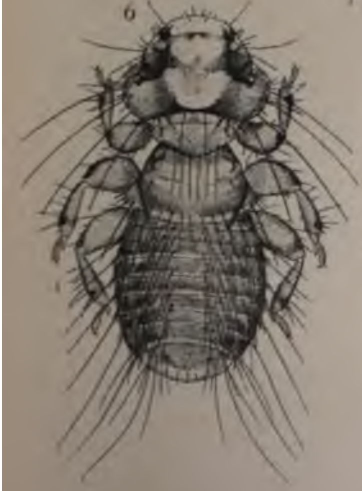

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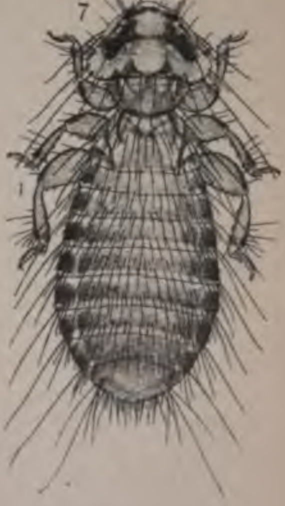

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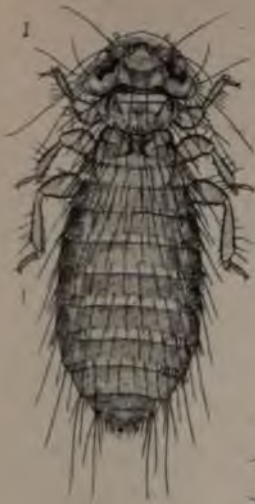

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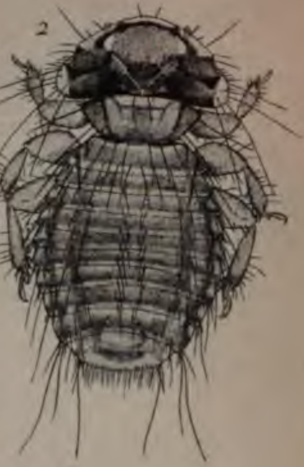

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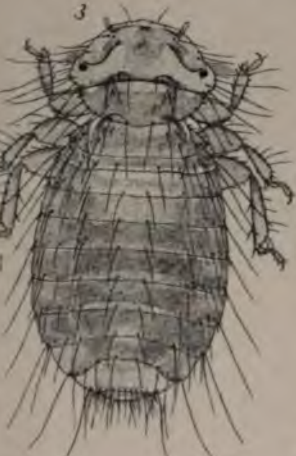

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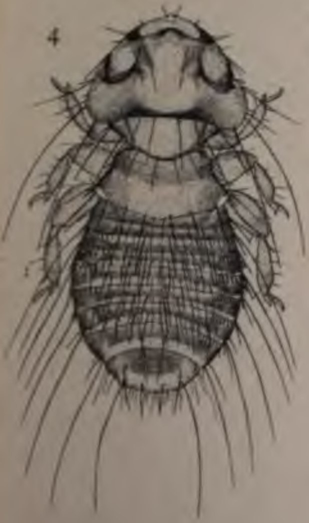

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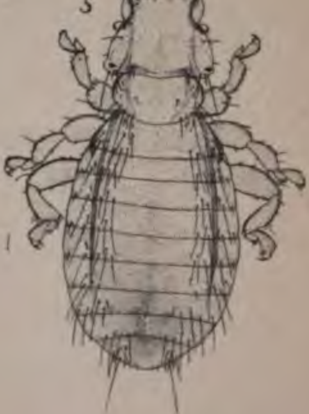

MARY WELLMAN DEL.

LITH BRITTON & REY, S.F.

THE ANATOMY OF THE MALLOPHAGA.

(With Plates X to XVII.)

BY ROBERT E. SNODGRASS.

The earliest work on the anatomy of the Mallophaga is that of Nitzsch. His results are comprised in his own announcement of his work, "Darstellung der Familien und Gattungen der Thierinsekten (insecta epizoica) als Prodromus einer Naturgeschichte derselben," published in the third volume of Germar and Zinken's "Magazin für die Entomologie," 1818, and in Giebel's "Insecta Epizoa, die auf Säugethieren und Vögeln schmarotzenden Insecten, nach Chr. L. Nitzsch's Nachlass bearbeitet," published in 1874. Both of these works are chiefly systematic, but the larger groups are separated on anatomical characters. The first purely anatomical paper is one by Wedl in 1855, "Ueber das Herz von *Menopon pallidum*." This paper is limited to a single organ. The next, by Kramer, "Beiträge zur Anatomie und Physiologie der Gattung *Philopterus* (Nitzsch)," published in Zeitschrift für Zoologie in 1869, includes all the organs of a single species (*Lipeurus jejunus*). The third and latest purely anatomical paper is Grosse's "Beiträge zur Kenntnis der Mallophagen," published in the same journal as the last, in 1885. *Menopon titan* (*Tetrophthalmus chilensis* Grosse), is made the basis for detailed descriptions, but the work is comparative, since more general descriptions of other forms are given, and the anatomical characters of the two main groups are pointed out. In 1869 Rudow published a paper, "Beobachtungen über die Lebensweise und der Bau der Mallophagen oder Pelzfresser, sowie Beschreibung neuer Arten," in which the principal anatomical characters are tabulated, and a long description of the mouth-parts given. The latter, however, is almost entirely incorrect. The mouth-parts were described wrongly at first by Nitzsch, then by Kramer, and finally by Rudow. Their correct explanation is due to Grosse. Rudow's paper contains an important statement concerning the number of egg-tubules in *Amblyceran* females. He says that there are five present of which two are rudimentary. Nitzsch could find but three, and Grosse apparently made no determination of the number present.[1] In 1869, also, Melnikow published in Archiv für Naturgeschichte, vol. xxxv, an embryological paper, "Beiträge zur Embryonal-entwicklung der Insekten" in which the embryology of the Mallophaga is described. Nusbaum in his paper, "Zur Entwicklungsgeschichte der Ausführungsgänge der Sexualdrüsen bei den Insekten," in Zoologischer Anzeiger for 1882, describes mainly two Mallophagan species, *Lipeurus bacillus* and *Goniocotes hologaster*.

I. GENERAL EXTERNAL ANATOMY.

External Form and Body-wall.—The body is generally very much flattened dorsoventrally. The segments of the thorax are often apparently only two, the mesonotum and metanotum being united. In others, however, the two are distinct although the former is narrow. In longitudinal sections of *Menopon titan* (plate x, fig. 1), the mesonotum (T_2) is seen to be separated from the metanotum (T_3) by a non-chitinized space, and is depressed below the level of the latter. The number of abdominal segments varies, but the largest is ten. The number in some cases varies with the sex. The head is flat, horizontal, situated closely upon the prothorax, and often excavated behind to receive the latter. In *Menopon persignatum*, as shown by transverse sections (plate xii), the head is very flat and comparatively wide. The side walls are very far from being perpendicular, and are scarcely distinguishable from the dorsal walls. They meet the floor of the cranium at a sharp angle. The top of the head is flat in front, somewhat concave behind. The prothorax is triangular in cross-section, having one angle median and ventral. The tergum is a little rounded. The mesothorax is more convex above and flatter beneath. The lateral edges are sharp and project over the bases of the legs. The metathorax is wider but otherwise similar to the mesothorax except in length. In the females of some species the abdomen is little or not at all flattened.

The body-wall of most species is well chitinized. In the abdomen the chitin is deposited in several areas around each segment (plate xv, figs. 3, 4, and 5, and plate xvii, figs. 1–5). On the dorsal side is a wide continuous plate reaching on each side to a short distance from the lateral margin of the segment. Likewise on the ventral side is a similar chitinization, and the two plates form respectively the tergum and sternum of the segment. Laterally, between the outer ends of these, are angular plates, one on each side, forming the lateral walls or pleura of the segment. The four are separated from one another by non-chitinized spaces. The intersegmental spaces are generally, especially on the dorsum, thrown into S-shaped folds, so that the posterior end of one segment overlaps the anterior end of the one in front. In some cases the chitinous tergum or sternum of a segment occupies only a small part of its length. In some the chitin is mostly accumulated at one place. An extreme example is shown in the terga of the anterior abdominal segments of *Eurymetopus taurus*. Here the chitin shows in longitudinal sections a large oval thickening near the anterior end of the segment, back of which it forms only a thin superficial plate reaching to near the posterior end. Anteriorly it terminates in a deeper but very short prolongation. The non-chitinized part in front is folded into a strong S-shaped band, the upper loop of which, forming the posterior border of the segment in front, projects over the anterior end of the chitinous thickening. Processes of the chitinous wall often extend into the body-cavity, especially in the thorax, giving attachment to various muscles. The antennary fossæ of the Amblycera are formed by chitinous processes from the lateral ventral margins of the head extending outward beneath the antennæ, and by a prolongation of the outer dorsal aspects of the head outward and downward (plate xii, figs. 1 and 2). Chitinous genital parts will be described under the head of the Reproductive Organs.

The Appendages.—The antennæ are three to five-jointed. In the Amblycera they are concealed in deep fossæ on the lateral ventral aspects of the head, and generally have the terminal segment enlarged. In the Ischnocera they are simple, filiform and exposed.

The mouth-parts have already been described in detail in Kellogg's "New Mallophaga, II,"* and merely a general account of their structure will be given here. They are of the biting type and consist of mandibles, maxillæ, and labium. The maxillæ (plate x, figs. 5, 6, 11 and 12) are large, strong, triangular, two-toothed structures, attached to the head by a condyle on one side and a socket on the opposite side of the outer basal angle. From the inner angle of the base a prolongation extends inward. The two teeth project from the inner edge, generally one distal to the other. The mandibles present two modifications, one found in the Amblycera and the other in the Ischnocera. In the former they lie parallel with the ventral surface of the head, so that the condyle is ventral and the socket dorsal. In this form one tooth lies in front of the other in a horizontal line in the same plane as the long axis of the mandible. In the Ischnocera the mandibles hang vertical to the head, so that the condyle is posterior and the socket anterior. In this form the distal tooth is typically ventral to the other in a vertical line in the same plane as the long axis of the mandible. The more proximal tooth, however, may be moved toward the tip and come to lie by the other and in front of it (plate x, fig. 6). In this case the two lie in the same horizontal line, but this is perpendicular to the long axis of the mandible. Starting with either type, the other may be produced from it by revolving the mandible on an axis passing from its outer to its inner basal angles. The degree of revolution varies in different Ischnoceran species, but the angle is always large and may reach 90°. In many cases there is a chitinous plate or rod attached to the inner angle of the base of the mandible, and a smaller one attached to the outer. These serve for attachment of muscles (plate x, fig. 12, *ch. pls.*) extending backward or upward into the head cavity. When they are absent muscle fibers are attached directly to the mandibles.

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* Proc. Cal. Acad. Sci., 2nd Ser., Vol. VI, 1896.

The maxillæ are generally simple, small, non-chitinized lobes, often provided with teeth on their inner edges. They lack palpi and distinct divisions into the ordinary parts (plate x, figs. 3 and 10).

The labium presents two forms, one in the Amblycera the other in the Ischnocera. In the former (plate x, fig. 9), there are present a submentum, mentum with two four-segmented palpi, and a ligula with two glossæ and two paraglossæ. The ligula is the only part that varies much, since it may have more or fewer than the four lobes named. In the Ischnocera a submentum, mentum, and ligula are present. The latter two are not well separated, but the paraglossæ are distinct (plate x, fig. 13) and very constant in form, being short, thick, cylindrical, and rather more chitinized than the rest of the labium. The glossæ are present between the paraglossæ as two small lobes.

In front of the mouth is the labrum, a large lobe situated on the ventral aspect of the head, generally some distance back of the anterior border of the clypeus.

The three pairs of legs are very similar throughout the group. The tarsi are two-jointed, and, with the exception of two genera, *Trichodectes* and *Gyropus*, that inhabit mammals, are provided with two claws, the others having only one. In some specimens of *Docophorus cursor* examined, the legs when at rest generally assumed the following positions. The femur (fig. 1) of the metathoracic leg extends outward and is inclined slightly forward

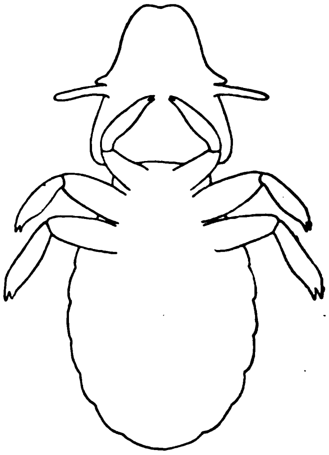

Fig. 1.

from the body. The femur of the mesothoracic leg extends outward also but a little more forward than the other. That of the prothoracic leg is inclined forward at an angle of about 45° with the body. Hence the fore legs are held mostly beneath the head and anterior part of the prothorax. The meta- and mesotibiæ extend backward, outward, and downward from the distal ends of the corresponding femora. The protibiæ extend backward, inward, and downward from the distal ends of the profemora, and their distal ends lie internal to the coxal ends of the femora.

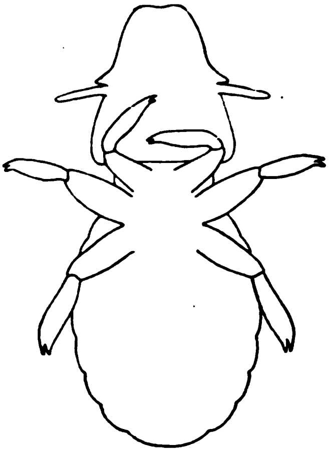

Fig. 2.

When the insect is walking undisturbed in forward longitudinal progression, the two legs of the mesothorax and of the metathorax move respectively together, but the two pairs move in opposite directions. That is (figs. 2 and 3), the two mesothoracic legs move forward or backward at the same time and the metathoracic legs move in the same manner, but while the mesothoracic legs are moving forward, the metathoracic legs are moving backward, and *vice versa.* Thus, while one pair of legs is pushing the body forward the other pair is reaching forward for a new grasp, and this is obtained just as the active pair has finished its work. The pair previously being carried forward then takes hold and continues the motion of the body, the two being themselves brought relatively backward. In this way the two pairs are always either approaching each other or are receding from each other.

The prothoracic legs do not move synchronously with either of the other pairs nor with each other. Generally (fig. 3) one moves backwards while the other is reaching forward. They appear mainly to guide the body. The femoro-tibial joint is most of the time in front of the tarsal claws, so that their power as propellers cannot be great. The parasite thus progresses along the feather with a hand over hand movement of the prothoracic legs, as of a man climbing a rope, while the other legs, a pair at a time, are continually pushing the body forward.

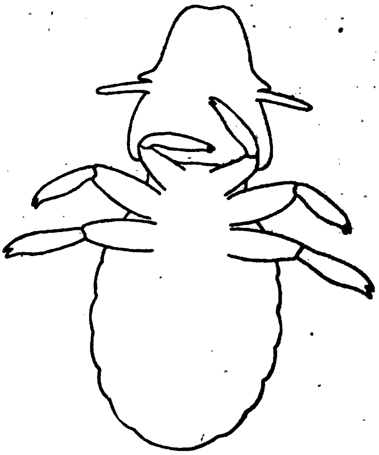

Fig. 3.

This is the typical movement of the legs and the one which prevails when the insects are walking quietly and regularly, but at times it becomes very much obscured by irregular movements and is generally more or less so, so that almost any relative position of the legs may be seen. The outer end of the metathoracic femur is seldom brought much farther forward than its coxa. The mesothoracic femur forms a smaller angle with the body in front, but not such a small one behind as the metathoracic leg. The femoro-tibial joints of the prothoracic legs are during progression brought forward, and the tibia also independently turns forward on the femur, so that the angle between the two increases and the tarsal claws are carried forward by a double motion. They then grasp the feather and by their own motion backward and by the motion of the body forward on the hind legs the femoro-tibial angle is again decreased and the leg assumes its former position. The insects run along on the feathers very easily, generally preferring the shaft. Those experimented with were kept on a few bits of feather on a glass slide. They ran along the shaft of a feather until they came to the end, then backed up a short distance, turned around, and ran back to the other end to go through the same performance there. They generally move with the head forward but can apparently go backwards or at any lateral angle just as easily; they nearly always, however, turn around when they wish to reverse the direction of movement. When several were placed on some guinea-pig hairs they appeared to be at no loss at all as to how to get along, and traveled just as well as on the feathers, although perhaps a little slower. Some Pediculids, however, from the guinea-pig, when placed on some feathers, appeared to be somewhat hindered by the network of barbs and barbules. The Mallophaga were entirely unable to progress upon the glass slide when they got off of the feathers, but the lice showed no difficulty at all in this respect; the latter could also right themselves when placed on their backs while the former could not.

II. THE ALIMENTARY CANAL AND ITS APPENDAGES.

The Alimentary Canal.—The alimentary canal presents two types of structure. One form is simple, having no special development at any part, the other is complicated by a lateral and backward prolongation of the crop, so that the latter forms a large expanded diverticulum of the œsophagus. The first form is confined to the Amblycera, the second to the Ischnocera. Of the first, the alimentary canal of *Menopon titan* (plate xi, fig. 13, plate x, fig. 1, and plate xvii, fig. 6) may be taken as an example. It has the form of an almost straight tube separable into six distinct parts. The first of these is a narrow elongated buccal cavity (plate x, fig. 1, *bc*) extending upward and backward from the oval aperture, by which it opens anteriorly, to the second part of the alimentary canal, the pharynx (*p*). This is a large cavity, oval in longitudinal sections, having its long axis extending backward and upward, but not so much in the latter direction as that of the buccal cavity, so that the two form an angle with each other. The pharynx lies mostly in front of the brain (*b*) and subœsophageal ganglion (*s.œ. g.*), the commisures lying laterad of its posterior end. Between the latter the pharynx contracts and passes into the œsophagus. This is rather long, narrow, gradually expands posteriorly, passes uninterruptedly into the crop, and forms with the latter the third division of the alimentary canal (*œ* and *cr*). The crop is of variable size according to the contents, but is rather large when distended.

The fourth part, the ventriculus, is long, wide in front and narrow behind, and connected with the crop in front by a short, very narrow neck. On each side of this it is produced into a large cæcum, the two embracing the posterior end of the crop. Back of the stomach is the intestine forming the fifth and sixth divisions of the alimentary tract. The first of these two consists of the prerectal part of the intestine and the second of rectum. The former is a short, straight, narrow tube, a little enlarged toward the middle and separated from the ventriculus in front and the rectum behind by slight constrictions. From its anterior end four Malpighian tubules arise. The rectum is very large (plate xi, fig. 13, and plate xvii, fig. 6, *r*). Its anterior part is much dilated, the enlargement being rather suddenly narrowed in front, but posteriorly gradually passes into the more tubular posterior part. Its anterior end is provided with six oval rectal glands. These vary in size in different specimens. In the male the anal opening is in the upper posterior part of the genital chamber, in the female it is in the end of the last abdominal segment (plate xv, figs. 1 and 2, *a*, and plate xvii, fig. 6, *a*).

Sections show the following histological features of the alimentary canal. The preventricular part is lined with a chitinous intima continuous with the body-covering at the mouth. The ventriculus lacks an intima, but possesses a thick inner cellular epithelium (plate x, fig. 1, *v*). The intestine has a thin chitinous lining continuous with the body-covering at the anus. The prerectal part possesses a thin cellular epithelium covered by an outer membrane, surrounding which are small muscle fibers. The rectum lacks the epithelium and has larger muscle fibers (plate xvii, fig. 6, *rtm*). The rectal glands project inwardly and are covered by the chitinous lining of this part of the alimentary tract.

In the Ischnocera, as before stated, the alimentary canal is complicated by a very remarkable condition of the crop. This in the genus *Trichodectes* has the form of a large sac connected with the lower end of the œsophagus by a long, narrow neck; in the other genera it forms a large transverse dilatation of the œsophagus, some distance above where the latter opens into the ventriculus. The crop is always produced much more to one side of the œsophagus than to the other.

The alimentary canal of *Eurymetopus taurus* may be taken as a type of this latter form (plate xi, fig. 11). The œsophagus is a long, slender tube reaching from the head to the mesothorax. Here it enters the anterior dorsal aspect of the crop. The latter lies dorsal and to the left of the other organs of the body-cavity except the heart, and extends from the middle line backwards and to the left, reaching the sixth abdominal segment when considerably distended. Its size and shape vary according to its contents, but it is generally much longer than wide, rounded in front, swollen toward the middle, and tapering behind. Its upper end extends a short distance beyond the opening of the œsophagus into it. About opposite the latter point, on the ventral aspect of the crop, the subingluvial part of the œsophagus begins and runs backwards to the ventriculus, forming a short, narrow tube. The ventriculus is smaller than the crop when the latter is fully distended. Anteriorly it bears two large, lobular cæca, each being rather flat and expanded beyond its base. The stomach lies with most of its long axis in an antero-posterior direction. It is widest through the middle; in front of this it is slightly constricted, while in the opposite direction it becomes very much narrowed, and, assuming a tubular form, makes a bend to the left. It goes a short distance in this direction and then meets the hind-gut. The latter turns immediately backward and runs in a straight line to the exterior. It is divided into an anterior, narrow, prerectal part and a posterior, enlarged rectum. The former bears at its anterior end the four Malpighian tubules, becomes enlarged toward its middle, and is separated posteriorly from the rectum by a slight constriction. The latter is much distended in front, where six large, oval, rectal glands are situated, but becomes narrowed posteriorly, the hind half being a straight, narrow tube opening into the upper part of the genital cavity. The relative size and shape of each of these parts vary greatly with their contents. The crop is provided with very prominent longitudinal and transverse muscles, which form a network of fibers over it.

It is evident that in such an alimentary canal as that just described there are two distinct divisions in addition to those of the alimentary canal of an Amblyceran species. The crop of *Eurymetopus* forms a part distinct and sharply separated from the œsophagus in front, and also sets off that portion of the œsophagus between itself and the stomach as a distinct division of the alimentary tract. The bits of feathers that form the food of the insect are generally almost as long as the crop and always lie in it in a longitudinal direction.

The alimentary canals of all other Philopterids in which this organ is known are similar in all essential respects to that of *Eurymetopus taurus* just described. In *Docophorus lari* the crop is very much like that of *Eurymetopus taurus* in shape (plate xi, fig. 8). It extends from the anterior left part of the body-cavity backwards and to the right. The œsophagus is narrow, lies in the middle line, and enters the crop some distance to the right of the anterior end of the latter. Arising from the ventral surface of the crop, at a point some distance to the left of the opening of the anterior part of the œsophagus into the same, is the subingluvial part of the œsophagus, which passes backwards a short distance and enters the ventriculus. This is rather long and tapers very much posteriorly. Its anterior end is provided with a large, lobe-like cæcum on each side. Its posterior end is a little bent just before it enters the hind-gut. The latter is short and narrow. The rectum is very much expanded anteriorly, having six prominent rectal glands surrounding the posterior end of the anterior smaller part of the intestine.

In *Goniodes cervinicornis* the crop is relatively very long and tapering (plate xi, fig. 12). It lies in an almost antero-posterior direction to the left of the rest of the alimentary canal. Its anterior end is large and rounded; posteriorly it tapers to a rather pointed extremity which reaches a little farther back than the posterior end of the ventriculus. When in the natural position its hind end is bent to the right and lies close to the stomach. The œsophagus enters the crop on its dorsal surface back of the anterior end. The part of the œsophagus between the crop and the stomach arises from the former in front of the point at which the anterior portion of the œsophagus opens into it. The stomach is rather long, but when it is distended it does not taper very much posteriorly, passing into the intestine by a rather sudden constriction. The two cæca at its anterior ends are relatively smaller than in the other forms described, and are merely blunt diverticula of the ventriculus without constricted bases. The prerectal part of the intestine is very short and narrow. The rectum on the other hand is unusually large, having its anterior end very greatly dilated and provided with six very large and much elongated rectal glands.

In *Lipeurus fuliginosus major* the crop lies to the left side of the body-cavity, the rest of the canal lying along the right. The ventriculus simply contracts posteriorly, passing gradually into the intestine, the two being separated by only a slight constriction. The rectum is comparatively rather long but otherwise both it and the rest of the intestine are very similar to the others described.

Nitzsch (1874) figures the alimentary canals of the following Philopterid species: *Docophorus fuscicollis*, *D. ocellatus*, and *Lipeurus jejunus*. That of *Docophorus fuscicollis* differs in no essential respect from those forms already described. In *D. ocellatus* the openings of the pre- and postingluvial divisions of the œsophagus are rather far removed from the nearer end of the crop. The ventriculus is very long and bent upon itself, forming a loop.

The genus *Trichodectes* (family Trichodectidæ) presents a rather remarkable deviation from the other Ischnoceran forms in the shape and position of the crop. As already mentioned, it is of the form of a sack connected with the œsophagus some distance in front of the ventriculus by a narrow, more or less elongated neck. In *Trichodectes geomydis* (plate xi, fig. 10), the crop is rather smaller comparatively than in most of the Philopterid forms, being about two-thirds the length of the stomach. The neck is long and slender, extending laterally from the œsophagus. The ventriculus is large anteriorly, where it is produced into two large cæca which are not constricted at their bases. Posteriorly the stomach becomes narrowed and makes an abrupt bend in the direction of the crop. After running a short distance in this direction as a narrow tube it passes into the intestine. This division of the alimentary canal goes backward from the midgut, forming a right angle with the posterior tubular part of the latter. The rectum is wide anteriorly, where it presents six glands as in the other families. In a *Trichodectes* from a horse the crop (plate xi, fig. 9) is the same as in *T. geomydis*, but is comparatively even a little smaller,

also, the neck is shorter. The ventriculus with its large gastric cæca is about the same. Nitzsch (1874) figures the alimentary canal of *T. climax.* Here the crop differs somewhat from the two just described in that the neck is very much shorter, the crop forming a pear-shaped diverticulum from the side of the œsophagus and separated from it by a narrow constriction. In this form the distal end of the crop is the larger, while in the Philopterid forms the proximal end is the larger, the distal end being generally more or less tapering and pointed. No intermediate form of a crop between the Philopterid and Trichodectid types has been found, and it is impossible to say which is the more primitive.

***Pharyngeal Sclerite.*—In many genera, including all of those of the Ischnocera, and one and part of another genus in the Amblycera, there is present a curiously** formed sclerite in the walls of the pharynx. It has already been described in Kellogg's "New Mallophaga, II," under the term "œsophageal sclerite." As shown there, it is a prominent, cup-shaped thickening of the chitinous lining of the ventral wall of the pharynx, forming a depression in the latter. From its sides (plate x, fig. 7) chitinous bands (*bs*) run upward around the pharynx and are connected by muscles with the dorsal wall of the head. From the anterior corners a large expansion (*ant. h*) on each side reaches forward and upward in the walls of the pharynx. Into the anterior end of its cavity a duct from two ventrally situated glands opens. The latter (plate x, fig. 2, *l.g.*) are oval, covered with a chitinous envelope, and supported by chitinous pedicles. From the anterior end of each a duct runs forward, after traversing the ventral surface, and then turns inward and backward to unite with the duct from the other side. The common duct thus formed then goes straight back to the sclerite. The shape of both these organs is very remarkably constant. In one or two genera they present deviations, and also in a few scattered cases, but these will be described farther on.

As was pointed out by Kellogg (1896), these organs are not peculiar to the Mallophaga but occur also in the Psocidæ, having been described for these insects by Burgess (1878). Outside of these two groups, however, they are not known to occur. Among the Mallophaga they are not of universal occurrence, but are for the most part confined to one suborder. Specimens of the following genera were had for examination: *Ancistrona, Colpocephalum, Docophorus, Eurymetopus, Giebelia, Goniocotes, Goniodes, Læmobothrium, Lipeurus, Menopon, Nirmus, Nitzschia, Oncophorus, Physostomum, Trichodectes, Trinoton.* The following table shows the distribution of the sclerite and glands among these genera:

Genera with Sclerite and Glands Present.	Genera with Sclerite and Glands Absent.	Genera with Sclerite and Glands Present or Absent.
Colpocephalum.	*Ancistrona.*	*Docophorus.*
Eurymetopus.	*Læmobothrium.*	*Lipeurus.*
Giebelia.	*Nitzschia.*	*Menopon.*
Goniocotes.	*Physostomum.*	*Nirmus.*
Goniodes.	*Trinoton.*	
Oncophorus.		
Trichodectes.		

The above table shows that those genera with the structures present belong, with the exception of *Colpocephalum*, to the suborder Ischnocera; while those in which they are absent belong, without exception, to the suborder Amblycera. Hence there are no Ischnoceran genera in which the sclerite and glands are absent in all species, although in three genera they are absent in a few cases. On the other hand, in the Amblycera they are absent in all but two genera, and of these one has them present in all species, but in the other they may be present or may be absent. Of thirty-eight species of *Docophorus*, twenty-six species of *Lipeurus*, and twenty-nine species of *Nirmus* examined—all that were accessible—only in *Docophorus icterodes*, *Lipeurus picturatus*, *L. longipilus*, and *Nirmus signatus* are the structures absent. From this it is evident that the exceptions to the occurrence of the œsophageal sclerite and glands in North American Ischnocera are few. It is worthy of notice also that the species of this suborder lacking them occur in the three largest genera,—the species of *Docophorus*, *Lipeurus*, and *Nirmus* being far more numerous than those of all the other genera of the same suborder together.

The following genera have been found so far only on European birds, *Akidoproctus*, *Boopia*, *Bothriometopus*, *Eureum*, and *Ornithobius*. Taschenberg (1882) and Piaget (1880), however, give good figures of all these genera, and in their figures the presence or absence of the sclerite is apparently intended to be shown, although whether it is or is not present is not stated in the description of each species. The figures can probably be relied on to show at least in what species it is present. According to them the structure is present only in *Akidoproctus*. This genus and also *Bothriometopus* and *Ornithobius* belong to the Ischnocera, so that it appears that there are two genera of this suborder in which the sclerite is absent; but this is without proof. If it is absent in the two Amblyceran genera, *Boopia* and *Eureum*, they agree with most of the other forms of their suborder. The sclerite appears to be absent also in *Gyropus*, an Amblyceran mammal-infesting genus*

In some species of several genera the sclerite is not of the typical form described. In *Docophorus pertusus* it is very much modified in form. The body is comparatively very small and the anterior processes are not present at all. On the other hand, the lateral circumœsophageal bands are greatly enlarged, forming a thick chitinous band passing upward around the pharynx. The body of the structure is so small that it appears merely as a median, backward-projecting enlargement of the rest. The dorsal cavity is present, its anterior wall and the anterior margins of the lateral wings are transparent and continuous with one another. The wings are expanded near their bases but distally each becomes narrowed and passes upward and somewhat forward as a slender curved rod. The structure is of about the same shape in a young specimen but the wings are proportionally smaller. In *Docophorus atricolor* the sclerite is small and weakly chitinized but the anterior processes are comparatively large and much expanded. In *Lipeurus diversus* the body is elongated, and in *L. squalidus* it is similar but with the anterior processes enlarged. In several other Ischnoceran genera the sclerite is variously modified, but the species in which modification occurs are scattered and not closely related to one another.

In the Amblycera only two genera possess the pharyngeal sclerite, and in these two the characteristic form is not that of the Ischnocera. It is, however, typically the

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*Taschenberg figures *Bothriometopus macrocnemis*, ♂ and head of ♀, and *Ornithobius hexophthalmus*, ♀ and head of ♂, in which the sclerite is not shown. But in *Akidoproctus rostratus* and *A. stenopygos* it is plainly present. Piaget figures *Boopia longitarsus*, *B. grandis*, *Eureum cimicoides*, *E. malleus*, *Gyropus ovalis*, *G. gracilis*, and *G. turbinalis*, in all of which the sclerite is not shown.

same. In *Menopon* and *Colpocephalum* the anterior processes of the sclerite are very much prolonged forward and are only slightly divergent. In some cases the sclerite is extremely reduced in size. In *Menopon fœdus* the anterior processes are not prolonged but are wide and bifid. These two genera are in other respects also very similar, and it is of significance that in the only genera of the Amblycera that possess the sclerite it has the same structure, different from that prevailing amongst the Ischnoceran genera, in each.

The following table gives the species of *Menopon* examined that have and do not have the sclerite and glands:

Genus *Menopon*.

Species with Sclerite and Glands Present.	Species with Sclerite and Glands Absent.
auro-fasciatum	*distinctum*
decoratum	*malleus*
dissimile	*persignatum*
fœdus	*præcursor*
funereum	*rediculosum*
incertum	*robustum*
indistinctum	*titan*
infrequens	*tridens*
irrumpens	
longicephalum	
loomisii	
melanorum	
mesoleucum	
monostæchum	
navigans	
numerosum	
paululum	
petulans	
striatum	

It is evident that the œsophageal sclerite and connected glands might be made use of in determining the relations of *Menopon* and *Colpocephalum* to the other genera, and also of the Mallophaga to other orders of Insects, since they occur also in the Psocidæ. But the probable number of yet unknown species is too great to allow of these structures being used to determine relationships of genera within the order.

The Salivary Organs.—In 1869 Kramer described the salivary glands of *Lipeurus jejunus.* In 1874 they were mentioned by Giebel in "Insecta Epizoa" from Nitzsch's notes. He gives no description of them. Finally, in 1885, Grosse gave a general account of their structure in the whole order, and a special description of those of *Tetrophthalmus chilensis* (*Menopon titan*). As far as is known, all species of Mallophaga possess two pairs of salivary organs; in some cases there is evidence that only one of each pair is a gland, the other being a reservoir. In any case either one gland and a reservoir or two glands are situated on each side of the crop or œsophagus. From the anterior end of each organ a duct arises and passes forward. The two ducts on each side unite with each other, forming a right and left common salivary duct. These run forward a varying distance and then approach each other and unite in the middle line. This final duct formed of the four primary ducts runs forward beneath the œsohpagus and enters the head where it opens into the pharynx.

In the suborder Amblycera the salivary organs appear to have no constant form characteristic of the subgroup. Grosse describes those of *Menopon titan* (plate xi, fig. 2) as consisting of a gland *(a)* and reservoir *(b)* on each side. The glands are elongate-oval, and each has a furrow on the inner side, from the middle of which the duct arises. The reservoirs are long and club-shaped, having the ducts passing forward from the anterior ends. He describes also the glands of a *Læmobothrium* as being composed of twenty small tubes situated upon the salivary duct like the teeth of a comb.

Nitzsch gives several figures showing the salivary glands. In *Menopon mesoleucum* two pairs of glands are shown of which the inner ones are very long and comparatively narrow. They extend in a straight course backwards along the sides of the alimentary canal as far as the rectal glands. In front they become narrowed and pass gradually into the ducts. External to each of these is a shorter gland. This one is also rather elongated and tapers in front and behind. The posterior end is coiled, while the anterior end passes into the duct. Grosse makes the general statement that the salivary organs consist of a salivary gland and a saliva reservoir, and that the latter are filled with a viscous substance.

In the Ischnocera the organs have a more definite shape, being much less variable among the different species. They consist of two pairs of glands and their ducts. Each pair lies on one side of the alimentary canal in the region of the anterior end of the crop and is composed of an outer, generally larger gland, and an inner, smaller one (plate xi, fig. 11, *r* and *g*). In *Trichodectes geomydis* (plate xi, fig. 1) the two are of about the same size. The inner one (*b*) has its long axis transverse and its larger end turned inwardly; while the outer is oval. The outer organ generally has the appearance of being a reservoir rather than a gland. Kramer studied the histology of the two and described the cells of the inner, smaller one as being remarkably distinct, while those of the outer he says are only with the greatest difficulty made out to be cells. He found the outer organs mostly filled with fat-like drops.

Both Kramer and Grosse describe a second set of salivary glands found only in the Ischnocera. Kramer described those of *Lipeurus jejunus* as consisting of a group of fourteen cells attached to the smaller of the two glands just described. He could find no ducts connected with them, but, since they were always present and constant in position and arrangement, he still regarded them as having a saliva-secreting function. Grosse observed them in the genera *Nirmus*, *Trichodectes*, and *Lipeurus*. He found, however, that they occurred not only on the crop but also in groups of two, six, and eight, connected with the fat body. On this account, and since he also could discover no duct in connection with then, he concluded that their function as salivary organs was very doubtful.

In *Trichodectes geomydis* there can be no doubt of this glandular nature, for here ducts can be very easily observed. If the alimentary canal be removed from the body and transferred to a glass slide, two sets of large cells may be seen attached to the anterior end of the crop. Each set consists of seven cells, each provided with two large, internal bodies, apparently nuclei. The cells are polygonal and situated close together. By detaching the mass from the crop and floating it out in water it may be seen to be connected by a very distinct duct with the upper end of the neck of the crop, close to where it joins the œsophagus (plate xi, fig. 10, *g*). This is long enough to allow the glands to lie on the upper end of the crop. On passing the glands under a cover-glass the loosely united cells spread apart and there may be seen very clearly a ramification of the main duct passing to each one of them (plate xi, figs. 3 and 4). It hence appears that in this species these cells form a compound gland of seven cells, each cell being provided with a duct of its own, the ducts of the several cells uniting and finally forming a common duct which opens into the alimentary canal at the mouth of the neck of the crop. In other Ischnoceran genera examined, including *Eurymetopus*, *Docophorus*, and *Goniodes*, these glands are present but the cells in each are more numerous. In *Eurymetopus taurus* (plate xi, fig. 5), each gland is composed of about twenty-four cells arranged mostly in two rows, although in some specimens, at the posterior end, they are three and four rows wide, so that the gland is posteriorly expanded. Each possesses two nuclear-like bodies, (one of these may be a hollow space into which the duct opens, such spaces being present in salivary cells of insects), and they are all closely pressed together so that they assume polygonal shapes. The presence of a duct is much more difficult to determine than in *Trichodectes geomydis*, but by removing the œsophagus and crop to a drop of water on a glass slide, as before, and pushing the glands away from the crop, they may be seen to be connected with the latter by a number of fine fibers. Upon focussing down on these with the microscope, one may be seen larger than the rest, possessing a double-bordered appearance characteristic of ducts when viewed with transmitted light. It is attached to the upper end of the crop at one extremity and at the other to the anterior end of the gland, where it divides close to the latter and becomes lost in the cells. By tearing the cells apart there may be seen attached to and ramifying between them, minute, delicate processes, apparently tubules.

A third set of glands opening into the anterior part of the alimentary canal are those of the head, already described in connection with the œsophageal sclerite.

With regard to the salivary glands, then, not considering those glands of the head, the two suborders differ as follows: The Amblycera possess simply two pairs of salivary organs—a gland and reservoir on each side of the alimentary canal. These are of variable shape, since they may be simple and relatively small or very large, or they may be compound, consisting of as many as twenty separate, secreting tubules. The Ischnocera possess a pair of simple, small, only slightly variable, salivary organs on each side of the alimentary canal. These are evidently the homologs of the salivary organs of the other suborders, since their ducts unite with one another in the same manner, and since their general position is the same. In addition, they have a pair of small compound glands each element of which consists of a single cell provided with a separate ductule. The species of the Amblycera are specialized individually, those of the Ischnocera as a group.

The Malpighian Tubules.—In all cases known there are four and only four Malpighian tubules. They are simple tubes generally variously dilated near their bases. This dilatation may form a short oval enlargement of the vessels as in *Docophorus lari* (plate xi, fig. 8), or it may be long, and even occupy half the length of the tube as in *Menopon titan* (plate xi, fig. 13). These enlarged parts of the tubes are very variable in size, and according to the specimen may be present and large or entirely absent in the same species. In *Colpocephalum osborni* the basal parts of the two tubes on each side are united for a short distance (plate xi, fig 7). The vessels are generally very much convoluted and form a tangled mass of tubes about the lower part of the alimentary canal. In others, however, they are straight. In *Menopon titan* they form V-shaped tubes with the bend forward and the inner arm joining the intestines. Each tube consists of an apparently structureless investing membrane (plate xi, fig. 6), of a single layer of large granular epithelium cells within this, and finially of a thin intima lining the epithelium. The lumen is narrow and irregular since the inner ends of the cells are angular, and a convexity on one side of the lumen fits into a concavity of the epithelium on the opposite side.

III. The Respiratory System.

The tracheæ are disposed in two main trunks, one on each side of the body, reaching from the posterior end of the abdomen into the head. Spiracles are situated laterally on the dorsal side of the abdominal segments, and in some species, as *Menopon titan*, there is a spiracle on each side of the prothorax (See Kellogg, 1896). A short branch connects each spiracle with the main longitudinal trunk of the same side. Opposite the union are given off several branches to the various organs of the body. In the head the lateral trunks end by dividing into numerous branches. No dilatation of the tracheæ occurs at any point. In *Menopon titan* a large transverse trunk connects the two lateral trunks in the fourth abdominal segment.

IV. The Nervous System.

The nervous system consists of a brain and subœsophageal ganglion in the head and a large ganglion in each of the thoracic segments. From the two head ganglia are given off branches to the mouth-parts and sense-organs. Each thoracic ganglion sends laterally a large branch to the corresponding legs. The last one gives off, in addition to these, branches that go backwards into the abdomen, supplying the organs there situated. In *Eurymetopus taurus* (plate xvi, fig. 7) the brain is large, much wider than long, and consists of two lobes united in the middle line. Each lobe expands greatly laterally. The posterior border of the brain is convex, notched in the middle line. The anterior border is very concave. The brain, therefore, presents from above the appearance of being composed of two large lateral masses connected in the middle line by a narrow commissure. From each anterior outer angle a trunk passes downward and backward to the anterior end of the subœsophageal ganglion. These form the circumœsophageal commissures, and from each a small trunk runs forward to a very large frontal ganglion situated in the median line between the anterior ends of the two cerebral lobes. The subœsophageal ganglion is larger than the brain and is situated in the lower part of the head beneath the œsophagus near the occipital margin. It is somewhat triangular in shape, with one side turned forward.

The brain and subœsophageal ganglion of *Menopon titan* (plate xvi, fig. 8) are very similar to those of *Eurymetopus taurus*. Dorsoventral longitudinal sections show that the brain is rather thick and that the lateral lobes are expanded posteriorly as well as laterally. The circumœsophageal commissures are inclined at an angle of about forty-five degrees. The frontal ganglion is smaller than in *Eurymetopus taurus* and is connected by a short trunk with the upper end of each circumœsophageal commissure. From it a branch runs forward to the labium. The subœsophageal ganglion is oval in longitudinal sections. The peripheral part of each is composed of rather large cells. Fibers pass from the lower ganglion through the commissures to the outer anterior angles of the brain, where they radiate in all directions to the peripheral cells. Transverse sections of the brain of *Menopon* sp. (plate xii, figs. 1-4, *br*), followed from before backwards, show in front the small, disunited sections which farther back (fig. 1) become enlarged in an inner and ventral direction and connected with the subœsophageal ganglion (*sg*) by two short, straight trunks. The latter ganglion is very flat in front. Back of the commissures (fig. 2) the lobes of the brain enlarge and become ovoid in sections, with the large end turned inward. The subœsophageal ganglion is still flattened and slightly constricted in the middle. Sections passing through the eyes (fig. 3) show a narrow commissure passing over the pharynx connecting the previously separated cerebral lobes which are now oval in shape. The subœsophageal ganglion is still flat but slightly enlarged laterally. Still farther back (fig. 4) the transverse commissure of the brain has increased in thickness, and the subæsophageal ganglion greatly enlarged, especially laterally.

The three thoracic ganglia are large, situated close together, and each is generally larger than the one in front. In *Eurymetopus taurus* each ganglion is hexagonal viewed dorsoventrally (plate xvi, fig. 7), with two sides transverse, one in front and the other behind. The most posterior ganglion is large and joined to the mesothoracic ganglion by its anterior side. From the lateral angles, which are a little back of the middle, large trunks are given off to the legs, and from the posterior angles larger branches, one on each side, go backwards into the abdomen. The mesothoracic ganglion is smaller than the last one, but, except that the lateral edges are more nearly equal, is very similar to it. Its anterior side joins the posterior side of the one in front, and from its lateral angles trunks arise that supply the mesothoracic legs. The prothoracic ganglion is more elongated than the others and the lateral angles are relatively farther back, but as before, the leg branches arise from them. There are no interganglionic commissures between the thoracic ganglia but the prothoracic ganglion is connected with the subœsophageal ganglion by two short, longitudinal trunks. In other forms the thoracic ganglia are a little more separated, but in all cases known, the nervous system is much concentrated and ganglia never occur in the abdomen. Longitudinal sections of *Menopon titan* (plate x, fig. 1) show that the thoracic ganglia (g_1, g_2, and g_3) are oval longitudinally and have an outer layer of large cells like those in the head. Transverse sections of *Menopon* sp. (plate xii, figs. 5–7) show that each ganglion (g_1 and g_2) is double and very large. In *Eurymetopus taurus* (plate xvi, fig. 7) each ganglion is supplied with tracheæ from a large, transverse commissure (*t r*) passing transversely from one main, lateral, tracheal trunk to the other. Each of these transverse trunks is applied very closely to the posterior part of the corresponding ganglion, and gives off into the latter numerous ramifying branches.

V. THE DORSAL VESSEL.

The heart was first described by Wedl in 1855. Nitzsch says nothing about it. Kramer in 1869, briefly described that of *Lipeurus jejunus*. Grosse adds little to the descriptions given by Wedl and Kramer. Wedl found that it could be studied successfully only in living animals. According to him the heart proper of *Menopon pallidum* is one-chambered and is situated in the next to the last abdominal segment just below the dorsal wall. The inner cavity is provided in front and behind with an opening. It consists of a molecular parenchymous part on each side, and a median membranous part. From the lateral, thickened part there arise ragged prolongations reminding one of the papillary muscles of the vertebrate heart, and which terminate in fine thread-like fibers attached to the median membranous walls of the heart. To the outer side of the parenchymous part are attached on each side a bundle of tense fibers, which may be termed the right and left suspensory fibers of the heart. The dorsal aorta has a swelling at its base forming a bulbus arteriosus. This has on each side a bundle of fibers, the right and left suspensory fibers of the bulbus arteriosus. Likewise at the opposite end of the heart is a swelling forming the bulbus venosus. This has two prolongations at its posterior end which appear to be inlet tubes allowing the entrance of the blood into the bulbus venosus. At the posterior end is a median row of fibers.

Kramer describes the heart of *Lipeurus jejunus* as a long narrow tube enlarged at its posterior end. Here are attached the very much reduced wing-muscles. Wedl does not mention these but very probably refers to them when he describes the "suspensory fibers". At the posterior end, according to Kramer, are four openings to admit the blood. Wedl states that the heart-beats amount to 112–120 per minute in specimens just taken from the living host, but sink to 56–52 in specimens taken from a host that has been dead a day or so.

He further describes the manner in which the different parts of the heart and aorta contract, and also gives an account of the methods he used in making his observations. Finally he states that he examined several representatives of the Philopteridæ, such as *Lipeurus variabilis, Goniodes colchici*, and *Docophorus atratus*, but apparently he determined merely that the heart is present in these forms.

VI. THE REPRODUCTIVE ORGANS.

The reproductive organs of both the male and the female may be divided ontogenetically into (1) parts derived from the interior of the body, including the testes or ovaries, the vasa deferentia or oviducts, and the vesicula seminalis, ejaculatory duct or vagina and spermathæca; and (2) into parts derived from the exterior of the body, including a genital cavity in both sexes, and an eversible penis with variously developed accessory chitinous parts in the male. According to Nusbaum (1882) the embryological origin of the internal organs of *Lipeurus bacillus* and *Goniocotes hologaster* is as follows: The parts arise from four fundaments. Two of these are derived from the mesoderm and give rise to the testes or ovaries and the vasa deferentia or oviducts; the others are derived from the epiblast of the ventral side of the fourth abdominal segment, and give rise to the vesicula seminalis and ductus ejaculatorius of the male or the vagina and spermathæca of the female. The second pair subsequently unite forming the unpaired organs of the adult. The latter are hence strictly external since they originate from the epiblast of the embryo. For convenience of description, however, the parts are classified better as internal and external genitalia, in which the terms *internal* and *external* are used relatively with regard to the adult structure.

1. THE MALE ORGANS.

The Internal Male Genitalia.—The testes are either six or four in number in adults, the former number being confined to the Amblycera and the latter to the Ischnocera. In the Amblycera they are variously-shaped organs lying in the lateral parts of the adominal cavity, three on each side, one in front of the other. Each opens by a short vas deferens into a common sperm duct. In the Ischnocera the testes are two in number on each side. They are generally pyriform, having the pointed ends turned away from each other and each terminated by one or two fine threads, and having the blunt ends approximated and connected by a short, narrow commissure from which the common vas deferens arises. The other internal reproductive organs of the male are essentially alike in the two suborders. The vas deferens on each side runs generally first backward from the testis and then turns forward to enter the sperm vesicle. The latter organ is usually single, but is composed of right and left lobes which in many cases are easily separated and which are sometimes normally disconnected. In all cases their lower ends open into a common ejaculatory duct. This goes to the exterior and may be either straight or variously bent. The two halves of the sperm vesicle when not entirely separated externally are essentially distinct, since each half possesses its own lumen, into which the vas deferens of the same side opens. Figure 4, then, may be taken to represent diagrammatically the typical condition of the internal male genitalia of the whole order. The figure as it is represents more exactly the Amblyceran structure, but the Ischnoceran may be produced from it by suppressing one testis on each side and drawing the other two toward each other while their distal ends are turned in opposite directions. Nusbaum states that in *Lipeurus bacillus* and in *Goniocotes hologaster*, two Ischnoceran species, the fundaments of the testes in the embryos form each three lobes, of which the posterior two develop into testes, while the anterior one atrophies. This anterior lobe, if it represents a third testis, establishes three on each side as the typical number of testes in the whole order.

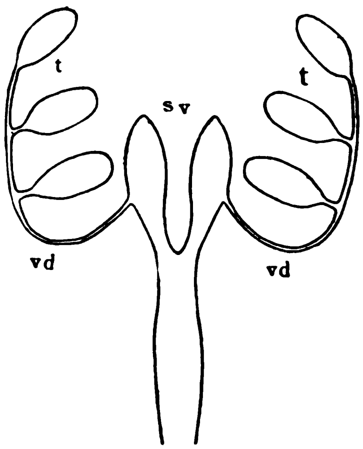


Fig. 4.—Diagram of the internal reproductive organs of the male Mallophaga; *t*, testes: *vd*, vasa deferentia; *sv*, vesicula seminalis.

In *Physostomum diffusum* (plate xiii, fig. 9) the testes are rather small. The most anterior is situated relatively rather far in front of the others, and is triangular in outline, having the base turned forward. Its posterior end becomes rather gradually narrowed, passing into the vas deferens. The middle and posterior testes are enlarged toward their bases and pointed at their distal ends. Each is connected with the vas deferens by a short vas efferens. The sperm duct runs a short distance back of the last testis and then turns forward to the seminal vesicle. This organ lies in the third abdominal segment. It is rather small, being about the length of the segment in which it is situated.

It is bilobed, being divided by median dorsal and ventral furrows into a right and left half. Each half is again partially divided by a longitudinal furrow into two secondary lobes, the outer of which is thinner than the other. From the posterior end of the vesicle a wide, almost straight ejaculatory duct passes to the exterior. Its lower half is provided with a strong, transverse musculature. The vasa deferentia appear to open into the ejaculatory duct at a point above its middle. They, however, merely become attached to this duct here, since they run forward along its sides, closely bound to it, and enter the sperm vesicle.

The vesicula seminalis of *Trinoton luridum* is elongated antero-posteriorly, tapers anteriorly, and is enlarged and rounded posteriorly. From it the ejaculatory duct runs forward and to the left. Soon it makes an abrupt bend backward and toward the middle line again, where it enters a greatly enlarged and very muscular division which opens to the exterior.

The whole reproductive system of *Menopon titan* is very greatly modified by an extreme complication of the different parts. They are all essentially the same, however, as in other species, and the modification is mostly confined to the parts developed from the exterior and to the muscles attached to these parts. These will be described farther on. The main modification of the inner organs is a great increase in the length of the ductus ejaculatorius. The testes (plate xiii, fig. 10, *t*) are oval, elongated tubes situated along the sides of the body. The most anterior on each side is connected with the anterior end of the vas deferens of the same side. The second and third are connected with the same duct at points farther back by rather long vasa efferentia. The part of the vas deferens between the first and second testes (beginning with the one in front) is longer than that between the second and third. The anterior end of each testis reaches some distance anterior to the posterior end of the one in front. Each vas deferens proceeds a short distance back of the last testis and then turns toward the median line of the body, the two are here connected by a transverse duct *(c d)* and enter the large mass of muscles surrounding the invaginated penis (this structure together with the muscles will be described under the head of the External Genitalia; see *postea*). They pass between the fibers and enter the cavity surrounded by them; turning then forward they run in this direction along the upper part of the cavity to the anterior end of the latter. Here they emerge from the muscles and go forward to the vesicula seminalis *(sv)*, each entering the side of this organ toward the set of testes with which it is in connection.

The seminal vesicle is very large, composed of two only slightly united lobes. It is elongated antero-posteriorly, tapering at both ends, and connected with the ductus ejaculatorius at its posterior ends. The latter is, as stated, a very long tube, and is consequently very much coiled. It begins at the posterior completely united end of the vesicula seminalis as a rather wide tube. It runs backwards from here only a short distance and then makes a turn toward the median line, the seminal vesicle being situated a little to the left. Here it makes a small loop upon itself and then runs forward to near the anterior end of the seminal vesicle, which reaches forward into the metathorax, making during this course a second loop upon itself. At the anterior end of the vesicula it makes a sharp bend backward, dorsal to the vesicula, and runs in a straight line to its posterior end, where it becomes narrower and turns toward the middle line. It reaches the transverse muscles of the penis and becomes here thrown into several loops, and then runs forward among the longitudinal muscles of the penis to the anterior end of the innermost (*int*) tube of the latter, with which it becomes continuous.

Nitzsch does not describe extensively the reproductive organs, merely giving a general description of them for the different suborders. He figures, however, the male organs of *Colpocephalum flavescens* and of *Menopon pallidum*. In the former (plate xiii, fig. 7) the six testes (*t*) are pear-shaped, situated with their broad ends upon the vasa deferentia (*vd*), with which they are connected by very short secondary ducts. Their pointed ends are terminated each by a short fiber. The vasa deferentia run backward and inward, uniting with the basal portion of the ductus ejaculatorius (*ej*) far from the vesicula seminalis (*sv*). The latter is somewhat elongated divided longitudinally to near its base by a median and two lateral grooves. The ejaculatory duct is very long. Immediately after leaving the vesicula seminalis it turns forward lateral of this organ and runs forward to some distance beyond its anterior end; the duct then turns backward and slightly inward, ending in a somewhat enlarged basal part to which is attached an internal chitin rod (*r*). In this form and in *Physostomum diffusum* the ductus ejaculatorius is very wide compared with this duct in *Menopon titan* and *Menopon pallidum*. In *Physostomum* it is provided with very prominent transverse muscle fibers.

In *Menopon pallidum*, as figured by Nitzsch, the testes are small, oval, and connected with the vasa deferentia by rather long ducts. The vasa deferentia are much convoluted in the portion lying between the testes and their proximal ends. The vesicula seminalis is expanded and four-lobed at its distal end, two lobes being situated on each side of the median line. From each of the two inner lobes a short twisted blind tube runs forward. The posterior end is rather pointed and passes into the ejaculatory duct. This duct is long and narrow, and is thrown into numerous convolutions, which, however, all lie between the vesicula seminalis and the external genital opening. The vasa deferentia open into the base of the ductus ejaculatorius.

The following are examples of the male organs of the Ischnocera. In *Eurymetopus taurus* (plate xiii, fig. 8) the testes (*t*) are four in number, two on each side. Each is a small pear-shaped organ having the tapering end terminated by a fine thread. The two on each side are closely connected by a rather wide commissure. They lie in the lateral part of the body cavity in the third and fourth abdominal segments close to the dorsal wall, with their long axes in an antero-posterior direction. From the inner side of the commissure connecting the testicles the vas deferens (*vd*) arises. It is a narrow tube passing first backward and inward and then forward and inward till it reaches the seminal vesicle (*sv*). Each duct enters the base of this organ on its own side. The vesicula is much the same as in *Physostomum* and *Colpocephalum*, it being partially divided into a right and left lobe by a median furrow. Each half is then again divided by median dorsal and ventral furrows on its surface. The two middle lobes of the four thus produced project farther forward than the lateral ones. Near the posterior end of the organ the four furrows cease and the ductus ejaculatorius (*ej*) takes its origin from a very short, undivided portion.

The ductus is separated from the vesicula by a constriction just in front of which the vasa deferentia terminate. The ejaculatory duct is divided into a wide, anteriorly and outwardly running, proximal part, and a narrower, longer, and posteriorly running, distal part. The two meet in front at an acute angle. The proximal dilated part is well provided with transverse circular muscles; the distal portion is also provided with muscles but not so prominently as the other. The ductus opens into the penis, but this will be described under the next heading.

The testes (*t*) of *Goniodes cervinicornis* (plate xiii, fig. 3) are rather more elongated than those of the last species described, but otherwise very similar. Their larger ends are approximated, and connected by a commissure narrower and longer than in *Eurymetopus*. The vasa deferentia (*vd*) are simple tubes passing from the commissure backwards and then forwards to the seminal vesicle (*sv*). They enter the latter, however, far up, almost at the midlateral points. In this form the vesicle is completely divided to its base into a right and a left lobe. Each lobe is elongated, tapering in front and behind. It is enlarged in its anterior half, and joined a little below its middle point by the vas deferens of the same side. The two lobes are connected with the upper end of the ductus ejaculatorius, whose lumen is formed by the union of the cavities of the seminal vesicle. A short, backward-running, proximal part of the ductus is comparatively very narrow. It soon, however, enters on the right a greatly enlarged division of the duct, which extends anteriorly and to the right of the vesicula. It is longer than the latter, wide through the middle, and narrowed at each end. Anteriorly it gradually contracts into the comparatively narrow, backward-running part of the duct. This proceeds to the penis, and in its course makes a bend to the left back of the seminal vesicle, then, after reaching the middle line of the body, goes straight to the exterior. The upper enlarged part of the duct is strongly muscular.

Nitzsch figures the male organs of two Ischnoceran species, *Goniocotes compar* and *Lipeurus jejunus*. In the former the pear-shaped testes abut closely upon each other by their large ends, and from between them the vas deferens passes by a convoluted course to the upper end of a posterior enlarged part of the ejaculatory duct. The latter is long and rather slender for most of its length. It makes a large bend forward as in the other species described, the inner arm of the loop likewise is considerably dilated, but a narrow neck intervenes between this part and the vesicula. The latter is partially divided anteriorly into two lobes.

Kramer (1869) describes very fully the male reproductive organs of *Lipeurus jejunus*. According to him the two testes on each side are acorn-shaped, having their pointed ends terminating in a fine-branched fiber. They are formed by a continuation of the outer homogeneous covering of the testes. Just where they leave the testes they contain three or four nucleated cells beyond which they become solid threads. Each divides into two main branches which are attached to the dorsal tube, but also by side branches to the Malpighian vessels and to other organs, so that they are simply members of the connective fibers that bind all the organs together. The slender vas deferens arises from the united larger ends of the testes. It consists of an outer structureless covering and an inner cellular epithelium. He describes the vesicula seminalis as an accessory secreting gland, stating that the vasa deferentia enter it and continue through it as an integral part, and then pass out as its duct forming the ductus ejaculatorius. Exception to this view will be taken farther on. According to Kramer the vesicula consists of a rather long duct and of the gland proper, the former widening itself suddenly into the latter. The walls of the duct are composed of several superimposed parts; surrounding all is a loose mass of fibers which are partly nerves and partly connective threads. Within this is a fine structureless coat only here and there provided with distinct nuclei, which is continous over the whole gland. Below this is a thick coat of cells in several layers. Lining the duct is a two-layered intima; where the duct passes into the gland the two layers diverge, the outer passing over the outside of the gland just beneath the outermost structureless membrane of the duct, which, as stated, passes over the whole gland also, and the inner continuing into the cavities of the gland as their intima. The cells of the cellular layer of the duct are contractile and appear to be muscle-cells corresponding with the muscular cells of the œsophagus and crop. At the lower end of the gland the vasa deferentia penetrate the two outer membranes and run forward beneath a series of wide cell-like plates, with which, however, they do not unite. They proceed forward thus, surrounded by the plates as by a sheath, along the middle of the flat surface of the gland to near its upper end, where they first enter its interior and then within traverse again its whole length. Within the gland they are surrounded by its secreting cells; at its lower end they unite to form the ductus ejaculatorius. It is to be noted that the muscle-cell layer of the duct continues for only a short distance over the base of the gland, the latter being situated within the cells as a flower in its calyx. Kramer further describes the penis and its muscles, and also the origin of the sperm and formation of the spermatophores.

Transverse sections through the testes of *Menopon titan* show that each is surrounded by a structureless outer tunica. Within this is an epithelium of high narrow cells projecting irregularly with ragged edges into the lumen of the organ. They are all more or less curved and together present somewhat the appearance of an iris diaphragm (plate xiii, fig. 1). An intima is apparently absent. The lumen of the testes is not very large and is filled, in prepared specimens, with a granular substance which is probably a coagulated fluid. The vasa deferentia have an outer tunica resembling that of the testes, within this a single-layered cellular epithelium. The cells are much smaller and relatively a great deal shorter than those of the testes (plate xiii, fig. 2). The lumen is small and lined by a thin structureless intima covering the inner ends of the epithelium cells. The seminal vesicle is composed of the same elements as the vasa deferentia. The epithelium cells are columnar but comparatively short (plate xiii, figs. 5 and 6). The lumen on the other hand is very large and filled with an apparently coagulated (in mounted specimens) non-cellular substance. The organ in sections is clearly seen to be a double structure, for the two halves are almost entirely separate. The two cavities communicate only through the upper end of the ejaculatory duct. The main connection between the two lobes is by an apparently outer layer of the tunica, which in the groove between the two sides passes across from one to the other, and an inner layer continuing around its respective lobe. In some places, however, in the basal half of the organ, the inner layers of the tunicas are absent and the opposing cells fused. The ejaculatory duct (plate xiii, fig. 4) has the same structure as the seminal vesicle and vasa deferentia. Outside of its tunica, however, is a layer of circular muscle fibers. These continue a short distance over the base of the seminal vesicle (plate xiii, fig. 5) and unite the lower ends of its lobes more firmly, but they soon cease.

From the preceding descriptions it is evident that figure 4, on page 177, represents the typical development of the internal genital organs of the males for the whole order. The only constant difference between the two orders in respect to these organs is the number and relative position of the testes. The latter organs have no constant form in the Amblycera although the variation is small, while on the other hand, in the Ischnocera the form is almost entirely constant. Thus, with respect to the sperm glands, as was found to be the case also with the salivary glands, the Ischnocera are specialized as a group, while the Amblycera are specialized among themselves on a less evolved type.

It now remains to consider the nature of the structure referred to as the vesicula seminalis. As stated, Kramer regarded it as an accessory gland, but he did not show what its function as a gland is. He found, further, that the spermatophores are not formed in the male ducts, but in the female spermathæca. That it is composed of united right and left organs is very evident. This is indicated by the fact that it is actually entirely divided into two lateral lobes in at least one form, and in others it is more or less deeply cleft, while in none known is it without a median groove. Further, according to Nusbaum (1882), it actually arises from two separated fundaments in the embryo, which subsequently unite. Kramer states that since the secreting cells are arranged around two tubes, the vasa deferentia, the organ has the appearance of being composed of two closely united glands, and that a separating wall is actually present. Grosse (1885) disagrees with Kramer and regards the structure as consisting of two bladder-like enlargements of the ductus ejaculatorius, which serve to retain the spermatozoa as they come from the testes until sent to the exterior by the contraction of the vesicle. According to him, accumulations of spermatozoa are to be found in the upper part of the organ. He states also that a secreting power cannot be denied to the cells forming the wall. The walls are thick and have a glandular appearance, but, other than this, proof of their secreting function appears to be absent.

The embryological investigations of Nusbaum, if correct, show clearly the relation of the vesicula seminalis to the adjacent parts. As has been shown, the vesicula generally presents a four-lobed appearance, being divided by three longitudinal constrictions of which the median one is the most constant and the best marked. According to Nusbaum the vasa deferentia unite with the fundaments of the reproductive organs derived from the epiblast. The latter then become each produced into two lobes at their anterior ends before they fuse with each other. Then, when they unite, there is produced a structure having a four-lobed anterior end to which the vasa deferentia are attached, and an undivided posterior part. The former becomes the vesicula seminalis and the latter by elongation the ductus ejaculatorius.

The External Male Genitalia.—The outer accessory structures connected with the inner reproductive organs have never been very carefully studied. Nitzsch (1818), Piaget (1880, 1885), and Taschenberg (1882) described them mostly as they appeared through the body-wall. Piaget made a few dissections. The external organs consist of two parts: (1) a simple or compound invagination of the body-wall of the last abdominal segment, and (2) chitinous parts developed in the walls of the invagination. In addition, however, there are muscles attached to these parts, situated within the body, and which are very important and sometimes very complicated adjuncts of the copulatory organs. The following descriptions represent all the genera of which males could be obtained.

Eurymetopus taurus (Plate XIV, fig. 5, plate XV, fig. 1).

The male has nine abdominal segments. The last tergum is very much narrowed from side to side, forming a triangular terminal dorsal plate with the apex, which is a little invaginated, projecting backwards. The sternum of the last segment, on the other hand, is much enlarged, projecting much beyond the corresponding tergum both posteriorly and laterally as a large plate with slightly upcurved lateral edges. Above this plate the top of the copulatory organ may be seen projecting a little beyond the end of the tergum. By separating these two plates a terminal cavity of the abdomen is exposed, having the chitinous penis lying along the middle line of its floor, and the anus opening into the upper posterior part. This space will be spoken of as the *genital cavity*, since it is evidently formed to accommodate the reproductive function, and since it contains the external part of the copulatory organ. The opening of the alimentary canal into it is apparently a secondary result, since the anus is terminal and exposed in the female when the genital cavity is in front of the last sternum.

Longitudinal sections through the male show that the genital cavity is formed by a wide invagination of the hind end of the abdomen (plate xv, fig. 1). The cavity is almost as wide as the body itself, and extends from the posterior border of the last segment far into the eighth. In its upper wall near the posterior margin is the anal opening (*a*). From its inner end an evagination of much smaller diameter than the primary invagination takes place, forming a long, rather slender, distally tapering tube in whose walls a thick deposit of chitin is present. This is the penis (*p*). From its base a large, wide chitinous plate extends forward *within* the body-cavity (*pl*). The part of the penis lying within the genital cavity will be spoken of as the *external* part of the penis, and the plate extending forward within the body cavity as the *internal* part. It is to be noted, however, that the plate is strictly external, since it is simply a part of the chitinous covering of the body, and that it is internal only in the sense that an inward-running process of the body-wall is internal. The genital chamber reaches much farther forward below the penis than above it. At the point where the internal and external parts of the penis are continuous, the ductus ejaculatorius (*ej*) enters into the evagination of which the outer part is formed, and opens by a terminal orifice to the exterior. The internal plate extends forward beneath the ductus ejaculatorius and close to the ventral wall of the body to the anterior border of the second abdominal segment. To it the muscles (*em*) of the penis are attached.

The penis (plate xiv, fig. 5) as a whole is a dorsoventrally flattened structure. Its anterior three-fourths is wide, forming the internal plate, while the posterior one-fourth is wide at its base but rapidly tapers beyond this. The posterior fourth is the external part formed by the chitinous thickening of the evagination described. Where the two meet, a large, square area is taken out of the penis. The margins at the side of and behind this are very thick. From the former arise two wide processes, one on each side, which rapidly contract and curve dorsally and inwards, almost meeting each other in the middle line. In front of these, two other processes arise from the anterior margin of the non-chitinized space, as two backward prolongations from the inner edges of the thickened lateral margins of the plate in front. They extend backward, outward, and slightly ventrally, terminating beyond the posterior edges of the lateral processes, and almost reaching across the unchitinized space. They are narrower than the lateral processes and taper but slightly. From the posterior thickened margin of the unchitinized area a third pair of processes arises. These are short, rapidly tapering, and continuous with the ventral edge of the transverse part behind the unchitinized area, this part being, as before stated, tubular. These processes lie close together, each just to one side of the median line. Their inner edges are slightly divergent and their outer edges strongly convergent and concave. Their tips reach about as far forward as the posterior ends of the processes in front. There are thus six processes—two in front, two behind, and one on each side—arching over the unchitinized space of the chitinous penis. They surround the terminal portion of the ejaculatory duct, since the latter passes beneath the arch formed by the dorsal processes on its way to the external tubular part of the penis. The several processes serve, however, partly for the attachment of muscles. The anterior half of the internal plate is comparatively very thin and tapers to a blunt termination in front. Back of the middle, also, the plate contracts somewhat toward its base. The external penis has a large, thick, basal part, which rapidly contracts to a slender, tubular, distal part, terminating by an arrowhead-shaped enlargement, the posterior angles of which are very sharp. This terminal tube curves downward a little toward its tip (plate xv, fig. 1), where its inner cavity opens to the exterior.

To the anterior end of the chitinous penis on its ventral side are attached two wide sets of muscle fibers. These pass backward, outward, and a little ventrally to the ventral wall of the abdomen. Each set is parallel-sided and arises from the penis just to one side of the middle line, and as the two diverge backwards they form only a very small angle with each other. To the other end of the penis are attached four sets of muscles, two dorsal and one on each side. Each lateral bundle is attached to one side of the enlarged subterminal part of the penis. It passes forward and outward, forming an angle of about 45° with the penis, to the lateral wall of the body-cavity. The dorsal muscles are near the middle line, and extend anteriorly, outward, and dorsally. These posterior sets are shorter than the anterior ones, ending on the body walls in the fourth and fifth segments.

The mechanism of the chitinous parts, invaginated tube, and muscles is self-apparent. The anterior muscles contracting push the chitinous penis backward, and it carries outward the partly evaginated inner tube of the genital cavity, the flexible walls of which become erected. In this way the external part of the penis can be protruded from the genital cavity, which during the operation becomes itself more or less erected. The posterior sets of muscles contracting reverse these movements, resulting in a withdrawal of the penis into the genital chamber.

Docophorus lari (Plate XIV, fig. 8).

The chitinous genitalia in this species consist of a large, thin, flat chitinous plate situated within the abdomen close to the ventral wall, and an external, conical tube with two articulated lateral arms. The plate is rather short, being less than twice as long as wide. Its greatest breadth is near its posterior end; it tapers somewhat forward but has a wide rounded anterior termination. The external part is tubular and represents an inner tube evaginated from the anterior end of the genital cavity. Its walls are very thick and entirely chitinous. In general shape it is, as stated, conical, having the internal plate passing forward from the ventral part of the anterior end. Its lateral outlines are slightly convex. Posteriorly it terminates in a slender median prolongation, at the extremity of which is the external genital opening. Into the anterior end of this part, dorsal to the internal plate, the ductus ejaculatorius enters. Five processes surround the slender, parallel-sided terminal tube. Two of them are dorsal, two lateral—one on each side, and one ventral. The latter is triangular in shape, rather elongated antero-posteriorly, and has the more pointed apex pointed backwards in the median line. The dorsal processes are much longer than the ventral one. Each is a flat plate reaching almost to the posterior end of the central tube. It expands toward its middle and then tapers off again beyond this point. The approximated edges are straight and lie each just to one side of the middle line, while the outer edges are very angularly convex. The lateral processes are short and thick, somewhat hook-shaped, with the ends turned outward. They reach a little beyond the ventral plate.

Two long curved rods are attached externally to the lateral aspects of the base of the outer part of the penis. Their anterior ends, by which they are movably articulated, are considerably enlarged. Each is curved throughout its length, so that the outer margin is convex and the tips, which extend a little farther backward than the median parts, converge. The part of the penis between these processes is very strongly chitinous. The lateral margins of the internal plate are much more strongly chitinized than the median part, so that in a cleared and mounted specimen the former alone show through the body wall. Consequently there is the appearance of an internal pair of rods extending forward from the bases of the external pair; and in many of the figures of Nitzsch, Piaget, and Taschenberg the chitinous genitalia of the males are represented as if this were the case. The plates serve, as in *Eurymetopus taurus*, for the attachment of muscles. One specimen was found with the penis protruded. The lateral external rods were turned forward, over the back of the insect, so that the median conical part was left projecting backward and upward alone. It is not very clear what the function of the rods is, since there are numerous forms, as will be shown, in which they are absent. The turned-forward position is probably not abnormal, since they were found thus in several specimens of other species, and some of the drawings of Piaget show them the same. They have the appearance of acting as a guard to the penis, or they may also serve as levers to prevent the latter from being pushed back into the genital cavity. The penis, however, is otherwise very much the same as in those forms where movable rods are absent.

Nirmus pacificus.

The penis is very similar to that of *Docophorus lari.* The internal part is a wide plate which tapers slightly forward and ends anteriorly with a wide rounded outline. The proximal half of each lateral margin is slightly convex and very thickly chitinized, so that the two give the appearance of a pair of curved prongs reaching forward into the body cavity, since the median part of the plate is comparatively very thin and transparent. Between the internal plate and the outer parts is a thickened portion common to both. The external penis consists of two lateral curved rods articulated to the base of the median external part. When the penis is retracted within the genital chamber, these two rods extend backward with their tips approximated and their concave edges turned toward each other. When, however, the penis is protruded, the rods turn forward over the back of the insect and become rotated outwards, so that their convex edges are toward each other and their tips divergent. The median external part is prolonged terminally into a slender, tapering, chitinous tube, which appears to bear at its end the genital opening. Surrounding this are five processes which arise near its base and are much the same as those of *Docophorus lari.* On the dorsal side is a pair of rather long slender plates, on the ventral side a slender median rod, and on each side a rather large, outward-turned process reaching a little beyond the extremity of the ventral rod. Ventrad of these last are two small cusps. The dorsal laminæ are much longer than the others, but the central tube projects a little beyond them. The last abdominal sternum is a wide, rounded plate which projects backwards so as to lie beneath the penis when this organ is protruded.

Giebelia mirabilis. (Plate XIV, fig. 4).

In this species the penis consists of the same parts as the two last described, there being present an internal plate, an external conical median part, and two lateral processes. The plate is wide and comparatively very short, its length being only a little greater than its breadth. It lies within the body close to the ventral wall, and to its dorsal surface muscles are attached. The sides are a little concave, its anterior border straight with corners rounded. The lateral basal parts are thicker than the rest. The external intromittent part of the penis is short, wide, with convex lateral edges, rapidly contracting distally, and ending in the middle line with a short, narrower prolongation. This is not entirely chitinized as in the other forms described for its distal half is almost membranous. At the base of the internal plate on its dorsal side the ductus ejaculatorius enters the external penis. The two lateral processes are short and thick, each being only a little longer than half the internal plate. They are curved, having the convex edges turned outward. They converge posteriorly but the tips are turned straight backwards forming an angle with the rest, so that the terminal parts lie parallel with each other. Their bases are enlarged and movably articulated to the rest of the penis as in the other forms described. The articulation is the same as that between the segments of the body and the joints of the legs; i. e., the parts are continuous but non-chitinized where the articulation occurs.

Goniodes cervinicornis. (Plate XIV, fig. 2).

The penis can be protruded for a distance about equal to three segments of the abdomen. The outer part consists of a delicate membranous tube evaginated from the inner end of the genital chamber. It is protected by three chitinous processes arising from a circular chitinization surrounding the base of the membranous penis. Two of the processes are lateral, long, slender, tapering, and somewhat convergent, with the outer edges convex and the inner concave. The third is ventral and median. It is a narrow chitinous rod having the distal end triangularly expanded, terminating some distance in front of the posterior ends of the lateral processes. These parts are free from the wall of the membranous penis but closely surround it. Lying within the dorsal wall of the latter is a thin, wide, chitinous plate arising also from the circular chitinous base of the penis. It is shorter than the ventral process, and has its edges a little concave. From the anterior ventral margin of the basal part of the external penis a large, thin, parallel-sided, chitinous plate, having a rounded anterior edge and slightly concave lateral edges, arises and passes forward within the body-cavity, giving attachment to protrusor and retractor muscles. It lies close to the ventral wall of the body-cavity, and at its base the ejaculatory duct enters the external penis. The opening into the latter is overhung by a wide tapering plate. The membranous penis extends beyond the ends of all the chitinous parts. When the chitinous structure is pushed outwards the outer processes and the common chitinous base are entirely exposed. It is to be noted that in this species the lateral processes of the external penis are not, as in *Docophorus*, *Nirmus*, and *Giebelia*, movably articulated to the base, and also that the median part is much less extensively chitinized.

Lipeurus fuliginosus major. (Plate XIV, fig. 1).

In this species the chitinous genital parts form a fork-shaped structure. A long, narrow plate lies within the body, representing the handle, while the external part consists of two prongs. The internal plate is comparatively much narrower than in any of the species so far described. It is a little contracted from side to side toward its base. Distally it gradually tapers to a blunt termination. Its posterior end expands suddenly and becomes bifid. Each arm is very short and extends backwards and outward, forming an angle of about 45° with the plate. The posterior borders of the two form a concavely rounded edge to their end of the plate. Attached to the posterior end of each of these prongs is a lengthened knife-like piece which extends backwards into the genital cavity. The two are dissimilar. The one on the left is larger, being both longer and wider, but they differ in still other respects. The left one has its outer edge convex proximally and concave distally; the inner edge of the same shows similar curves but in opposite order. The end tapers down to a point directed somewhat outwards. The outer edge of the right smaller prong has an outline corresponding with that of the inner edge of the left prong. That is, it is concave toward its base and convex toward its tip. The inner edge is convex at the middle, decidedly concave proximally and slightly so distally. Hence its point is turned inward—relatively opposite to that of the left prong.

The bifid posterior end of the internal plate is imbedded in the base of the chitinous penis. The outer prongs are attached to the arms of the bifurcation in a manner much different from that in other forms. The base of each prong is a little expanded and bears two tapering processes projecting inwardly and anteriorly, one lying dorsal to the other. The dorsal process is the larger; it is curved so that the posterior margin is concave and the anterior convex. The tips of the dorsal processes of the two sides are directed toward and lie close to each other. Each is connected by a delicate dorsoventrally flattened chitinous bar, which passes outward to the arm on the same side of the bifid base of the internal plate, and fuses with it very near its posterior ends. The ventral process is smaller than the dorsal one; its posterior edge is convex and its anterior edge concave. The end of each arm of the plate abuts upon the corresponding prong between the bases of the two processes of the latter, the transverse slender bar of chitin serving to connect the two otherwise separated parts. Lying in the dorsal wall of the membranous penis is a thin chitinous plate. It extends from near the bases of the lateral prongs to a short distance from the distal end of the smaller one. It also is symmetrical. The right edge is about straight and distinctly marked; it lies nearer the side of the penis than does the left edge, so that the plate is not median. The left edge is much less sharply defined and extends obliquely from the left side of the base of the penis posteriorly and toward the middle line. To the dorsal side of the internal plate is attached a large mass of muscle fibers, and on the same side of the plate the ductus ejaculatorius enters the penis.

Oncophorus bisetosus californicus.

There is nothing in the genitalia of this form different from those already described. The chitinous parts consist of a rather wide internal plate with thickened margins and transparent central part, and of an outer median tapering chitinous intromittent organ with articulated lateral processes. Piaget figures *Oncophorus unguiculatus* in which the genitalia are apparently the same as in the form just described.

Goniocotes creber. (Plate XIV, fig. 9).

In this form the chitinous genitalia are extremely reduced. Within the body is a long narrow plate reaching almost to the anterior end of the abdomen. It is very thin and transparent except laterally, where it is weakly chitinized, giving the appearance of two long, very delicate, slightly curved rods lying within the body. Each of these is continuous externally in the wall of the penis. Their outer parts are more chitinized, the tips sharp and convergent. Muscles are attached to the internal part. Piaget figures several species of *Goniocotes* in which the chitinous genital parts are about the same as in *G. creber*, consisting of an internal plate with external prongs. In some the plate is evidently more chitinized than in this form.

The species whose genitalia have been described are all Ischnoceran forms; the following belong to the Amblycera and it will be seen that the genitalia are more simple than in the others, though essentially the same.

Trinoton luridum. (Plate XIV, fig. 7).

A genital chamber is present with a membranous penis arising from its inner end. The chitinous parts consist of a long, slender, tapering rod running forward within the body cavity from the base of the penis. Its posterior end is expanded and bifid, the prongs being external and imbedded in the wall of the penis. They extend posteriorly and a little outwards, each being a little longer than half the length of the internal rod. Each prong ends bluntly posteriorly, but some distance in front of its posterior end it gives off a process wide at its base but soon narrowing very much, which runs dorsally a short distance and then turns posteriorly, extending in this direction parallel with the main prong from which it arises past the posterior end of the latter, and then turns inward to meet and fuse with the corresponding process of the other side. This median part is very weakly chitinized. The arc thus formed lies in the dorsal wall of the membranous penis, while the two prongs are lateral. The penis extends some distance beyond all the chitinous parts. The ductus ejaculatorius enters it above the internal rod, which latter serves for the attachment of muscles. The intromittent organ in this form, then, consists of a membranous tube evaginated from the inner end of the genital chamber, in whose walls chitinous rods are developed which unite anteriorly to the ventral wall of the tube and send forward a chitinous rod into the body cavity.

Colpocephalum osborni. (Plate XIV, fig. 6).

The genitalia of this species are very similar to those of *Trinoton luridum* just described. The only difference is that the processes arising from near the posterior ends of the prongs of the fork-shaped structure do not meet each other. In addition to these, however, there is present in the dorsal wall of the membranous penis a chitinous arrowhead-shaped plate, which reaches about half way to the ends of the lateral prongs and is connected with the latter by wings from its base, which reach the prongs a short distance back of their divergence. There are also developed in the walls of the penis numerous small, granular chitinizations.

Physostomum diffusum. (Plate XIV, fig. 3).

The chitinous genital parts of this species are very simple. There are present in the walls of the penis two diverging lateral rods which meet in front. Here they send forward into the body cavity a very small rod, it being about a third of the length of each outer prong, to which muscle fibers are attached. The posterior ends of the prongs are connected by a transverse, angular bar.

Menopon mesoleucum. (Plate XIV, fig. 10).

A long, rather thick internal rod is present. This arises from the united anterior ends of two thick bars in the walls of the penis. These bars are very short and do not nearly reach the end of the penis. To the end of each is articulated a longer tapering rod free from the penis and reaching to its posterior end. These have the appearance of being homologs of the articulated lateral prongs in some of the Ischnoceran forms.

RÉSUMÉ.

From the preceding descriptions it is clear that the outer genitalia of the male may be generalized as follows. The posterior end of the last abdominal segment is invaginated to a varying extent, forming a genital chamber surrounded by the walls of the body, possessing a chitinous lining continuous with the body-wall, and opening posteriorly to the exterior. Into its anterior end the ductus ejaculatorius opens, and the part in which the operation occurs is carried backward

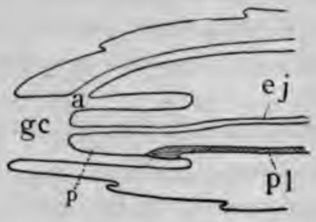
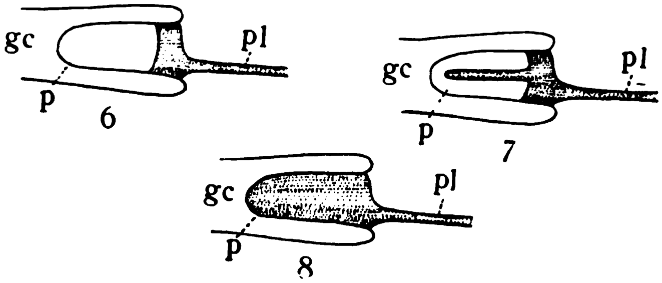


Fig. 5.—Diagram of external genitalia of male Mallophaga; *a*, anus; *gc*, genital chamber; *ej*, ejaculatory duct; *p*, penis; *pl*, internal plate arising from chitinous thickening in base of penis.

as an invagination forming an internal tube arising from the anterior wall of the genital chamber. This tube is the penis. Figure 5 represents diagrammatically what has just been described. It is evident that if the inner walls of the genital chamber are flexible the penis could be entirely protruded from the cavity containing it. Specimens killed in alcohol are often found with the penis projecting in this manner. The anal segment is lacking, so that the rectum opens into the genital chamber.

The chitinous genitalia are formed as chitinizations in the walls of the inner tube. The object of this is double, (1) to strengthen the walls of the penis, (2) to give attachment to muscles for protruding and retracting the penis. The latter function is apparently the more important, since a contrivance for its accommodation is never absent, while chitinous parts strengthening the penis are in some cases very slightly developed and in a few, such as in *Menopon titan*, yet to be described, and in some species of *Colpocephalum*, are entirely absent. The structure which gives attachment to the muscles is always of the form of a chitinous prolongation into the body cavity from a chitinization in the ventral part of the base of the penis. It may, therefore, be represented as in figure 5, *pl*. This internal structure may be short or long and either narrow or broad, but it is always essentially the same and lies ventral to the ductus ejaculatorius. The external parts are developed as various degrees of chitinization radiating through the walls of the penis from the ventral basal chitinous deposit. The simplest and most usual form consists of a rod given off backward on each side (fig. 6) such as in *Menopon mesoleucum*, *Trinoton luridum*, *Colpocephalum osborni*, and others.



Figs. 6-8.—Diagram showing successive degrees of chitinization in walls of penis: *p*, penis; *gc*, genital chambers; *pl*, internal plate.

Secondary processes may be developed from these. In others the basal chitin may completely surround the penis (fig. 7) and, besides lateral processes, may give off dorsal and ventral ones as in *Goniodes cervinicornis*. Further, this circular basal chitinization may extend continuously backward (fig. 8) and transform the penis into a chitinous tube, as in *Docophorus lari* and in *Eurymetopus taurus*. Independent chitinizations may also be developed in the penis, taking the form of plates and granulations in its walls, as in *Lipeurus fuliginosus major*. It cannot be stated whether the articulated lateral processes are homologous with the non-articulated lateral pieces or not—embryology must decide this. However, since the two are not known to be present in the same form, and since in *Goniodes cervinicornis*, at least there are non-articulated processes free from the lateral walls of the penis, it might be inferred that the two may be homologous.

Comparison shows that the simplest forms of external genitalia occur in the Amblycera, and that in none of these are the parts much complicated. On the other hand, the genitalia in nearly all the Ischnocera are very much more developed, and are characterized by a much wider spreading of the chitin in the walls of the penis, and of a relatively much larger development of the internal process. The condition of the external reproductive organs in the two suborders hence agrees with that of the internal organs, for it was before shown that the latter are the more specialized in the Ischnocera.

The structure of the intromittent apparatus of *Menopon titan* will now be described (plate xiii, fig. 10, and plate xv, figs. 2–5). It is so very highly developed and so complicated, being much more so than in any other form known, that it is more easily understood after a study of the more typical structure found in other species. Grosse has described it but apparently not very correctly. He says that the last abdominal segment of the male is invaginated and runs forward in the body to the border of the last and penultimate segments, and then goes again backwards in order to continue anew anteriorly, tube-like, to the sixth segment. Surrounding this are transverse muscles, and attached to its anterior end longitudinal muscles. He next states that within the invaginated segment is a tube open at both ends, which anteriorly passes into a gradually decreasing chitinous rod reaching to the third abdominal segment, and that within this tube is still another which continues anteriorly into a whip-lash beset with numerous spines or bristles. It is rather hard to imagine how structures such as these could exist in the manner described; and dissected specimens, entire specimens cleared with *Eau de Labarraque* and stained, and sections cut in longitudinal and transverse directions, indicate that Grosse's description is not entirely correct. The structure of the various parts which Grosse has mentioned is apparently as described in the following account.

When the abdomen of the male is opened from above there is to be seen in it, lying along the middle line and ventral to the alimentary canal, a large, compact mass of muscles reaching from the last segment into the fourth. The posterior three-fourths of this mass is composed of transverse fibers, and the anterior one-fourth of longitudinal fibers which converge to a point in the fourth segment. This structure forms the most prominent organ in the abdomen and is easily taken entire from the body by detaching it from the body-wall at the posterior end. Under a low-power lens it can easily be seen that the transverse muscles of the posterior three-fourths are much curved, but are a little less than semicircular. Their dorsal ends are attached to a vertical sheet of membrane which extends down between them from above as a fold from a thin membrane surrounding the whole mass. Their lower ends are attached to a thin, transverse, ventral plate. By dissecting the fibers apart it is found that they, together with the ventral plate to which their lower ends are attached, surround a cylindrical cavity. Within this is a thin-walled, membranous tube open in front. This latter contains a second thicker and more chitinous tube and a chitin rod. The rod arises posteriorly from the inner tube. Between the outer tube and the muscles on the dorsal side of the former lie the forward-running parts of the vasa deferentia. These enter the muscles posteriorly and then pass into the upper part of the cavity within them, run forward to the anterior end of this, and then emerge to join soon the seminal vesicle. The inner tube and rod pass forward some distance beyond the anterior end of the outer tube, and the former is thrown into several convolutions which vary in different specimens. The anterior longitudinal muscles arise from the anterior end of the mass of transverse muscles and converge upon the tip of the chitin rod. From these a small band of fibers continues into the thorax, where it is attached to the floor of the metathorax in the middle line. The transverse muscles, when detached from the ventral plate, but left with their upper ends still joined to the vertical membrane, have very much the appearance of a bunch of fire-crackers, the fold of membrane representing the axial fuse.

The inner tube on account of its being more strongly chitinous than the other appears dark, while the outer is transparent. The interior of the inner tube is beset with numerous chitinous projections. In the posterior part these are of the form of small conical processes closely distributed over the walls. Somewhat farther forward they increase in length and form sharp backward-pointing teeth. Still farther in front they become much more elongated, and anterior to these they take the form of large backward-projecting, spike-shaped appendages having sharp points, and they almost obstruct the lumen of the tube. Beyond these a decrease in size of the processes takes place, and in the walls of the anterior part of the tube they are entirely lacking, the tube being here transparent. Beginning at the posterior end the tube runs straight forward to near the anterior end of the transverse muscles. In the longitudinal muscles it becomes folded and a loop may project from the latter. It is here of greatest diameter. It becomes narrowed in the part that has no internal processes and gradually passes into the comparatively narrow ejaculatory duct. To its posterior end the chitin rod is attached. This is circular in transverse sections, rather long since it reaches into the fourth segment, and tapering anteriorly. It is curved, having the convexity to the right and dorsally.

The relationships of these different parts is very clearly shown by transverse and longitudinal sections (plate xv, figs. 2–5). The posterior end of the last (the ninth) abdominal segment is deeply invaginated, the invagination running forward into the fifth segment. The walls of the tube thus formed (plate xv, figs. 2, 3, 4, t_1) are very thin and transparent, being entirely nonchitinized. In the anterior part of the sixth segment, however, they begin to increase in thickness and continue to become thicker from here forward to their anterior ends in the fifth segment. Here they turn away from the axis of the tube they form and then curve backwards a short distance. Then they become thin again and turn sharply forward and inward, closely following the inner face of the first bend. This is the beginning of an evagination which extends backwards almost to the beginning of the first. The walls of this are likewise very thin and transparent, and are closely applied, except posteriorly, to the inner surface of the first tube. There is thus formed a double-walled tube open in front and having a recurved anterior edge.

This is the outer of the two tubular structures to be observed by dissection alone and it is surrounded by the transverse muscle-fibers (plate xv, figs. 2, 3, 4, t_1 and t_2). This is probably what Grosse referred to as a tube open at both ends.

In the anterior part of the eighth segment the walls of the inner tube diverge from those of the outer one, leaving a free space between them connected with the exterior. A short distance back of where the two diverge the walls of the inner tube are bent backward and then again forward, forming a free cylindrical fold projecting backward. This extends posteriorly to the middle of the last segment and then ends by being invaginated and forming within itself a third tube (plate xv, figs. 2, 3, 4, t_3). The posterior part of the walls of these two are fused for a short distance and closely united as far forward as the fold in the second. Here the innermost tube becomes entirely free and lies as within a sheath surrounded by the first and second tubes. This is the inner tube so easily determined by dissection; it runs forward as before described, passing out of the cavity between the other tubes and entering the longitudinal muscles (plate xv, figs. 2 and 5 t_3, and plate xiii, fig. 10 *int*). The chitinous rod (plate xv, figs. 2-5, *r*, and plate xiii, fig. 10, *r*) is attached to the fused part of the second and third tubes back of the posterior fold of the former. Only its anterior end is shown in median longitudinal sections. It is the homolog of the internal rods or plates of the chitinous genitalia already described.

It is readily seen that the intromittent organ of *Menopon titan* is simply an exaggeration of the type of that found in other species. It consists first of a deep invagination of the body-wall, extending from the posterior end of the last abdominal segment forward into the fifth. (Grosse states that this is the turned-in tenth segment of the male. Beyond the fact that the male has one segment less in the abdomen than the female, he gives no evidence for this conclusion). The cavity thus formed corresponds exactly with the genital chamber of other species. Into the posterior part of it the rectum opens from above. Its anterior end is evaginated, and the tube thus formed is homologous with the membranous penis of other forms. It is almost destitute of chitinization, however; the rod arising in other species from the base of the penis is here situated near the tip. It appears from this that the elongation of the parts has been brought about, not by a deepening of the genital cavity with a corresponding lengthening of the penis in a posterior direction, but by a deepening of the genital cavity with a lengthening of the penis in front of its base. The innermost tube is produced by an invagination of the posterior end of the penis and is either unrepresented in other forms or is comparatively extremely short. Figure 9 represents diagrammatically the relation of the several tubes, and a comparison of this figure with fig. 5 shows the similarity of structure. (cf. also plate xv, fig. 2 with fig. 1).

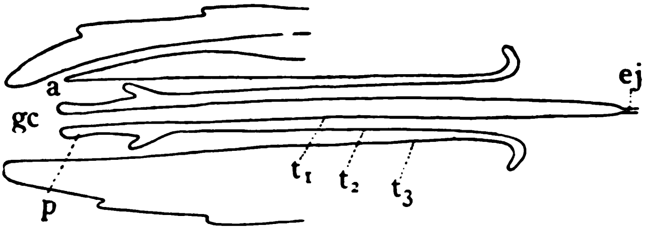


Fig. 9.—Diagram of Intromittent organ of *Menopon titan*, male; *a*, anus; *gc*, genital chamber; *ej*, ejaculatory duct; *p*, penis; t_1, innermost invaginated tube; t_2, middle invaginated tube; t_3, outermost invaginated tube or wall of genital chamber (cf. fig. 5).

The muscles surrounding the tubular structures are also very complex, as has been shown. The plate to which the ventral ends of the transverse fibers are attached arises from the body-wall between the sterna of the eighth and ninth segments of the abdomen (plate xv, figs. 2 and 4, *p*). The proximal end of this plate is non-chitinized but farther forward it becomes darker. It ends in the ventral part of the groove formed by the recurved ends of the first and second tubes. Its lateral edges curve somewhat dorsally. The muscles are surrounded by a very thin, delicate membrane (plate xv, fig. 2, *m*) which along the median dorsal line sends a fold downward a short distance to which the upper ends of the transverse muscles are attached. In the middle the muscles are seven or eight fibers deep but the number lessens toward each end. They curve laterally around the tubes and each layer is attached to the ventral plate internal to the layer just outside it.

The longitudinal muscles, as stated, form a conical mass of fibers converging upon the anterior end of the rod, from which a few run forward to the sternum of the metathorax. There are a few transverse muscles within the others, especially close around the contained tube (plate xv, figs. 2 and 5, *lm*). It is rather difficult to determine how the longitudinal muscles are attached posteriorly. It appears clear, however, that they are not attached to any of the tubes but to the ventral plate, and in the following manner: The anterior end of the plate curves laterally very much upward around the outermost tube. The upper lateral and dorsal fibers posteriorly, in front of the recurved anterior ends of the first and second tubes, curve downward and inward, crossing each other in the middle line. They then turn backward, passing over the rim of the tubes, and are attached mostly to the lateral ventral aspects of the anterior end of the ventral plate, but a few are attached on the dorsal side. The lower lateral and ventral muscles likewise cross each other in the middle line in front of the tubes and are attached to the lateral aspects of the dorsal side of the anterior end of the ventral plate. The mechanism of this complex structure is rather hard to understand. It is evident that the contraction of the longitudinal muscles must push the rod outwards, carrying with it the innermost tube. The posterior fold in the second tube appears also, as if present to accommodate such an action. Grosse states that during copulation the whole inner tube is everted. It is difficult to understand what it is for if it is not made use of in this way, but it is much more difficult to see by what means it is turned out, since in front of the attachment of the rod at its posterior end it is entirely free from everything except the ejaculatory duct. Those specimens examined in which the inner tube was most everted had this protruded only as far as the base of the rod, the longest length apparently possible, judging from the structure of the parts. There can be little doubt that the band of muscles connecting the anterior end of the rod with the floor of the metathorax serves to draw the rod back. The transverse muscles may serve to prevent the lateral bending of the rod while the longitudinal muscles are contracting.

2. THE FEMALE ORGANS.

The reproductive organs of the female consist, like those of the male, of internal and external parts. The external part consists merely of the genital cavity, with the abdominal sternum forming its floor produced into a variously modified plate. The genital cavity differs from that of the male in not being situated in the terminal segment of the body, but by being found as an invagination of the ventral body-wall several segments forward. It also does not contain the anal opening, this being situated terminally in the last segment.

The external parts of the female are much the same in all forms and the female *Menopon titan* may be described as a type of the whole order. Grosse describes the female organs of this form, but only very briefly, and he says nothing at all of the external parts. The sternum of the eighth abdominal segment is considerably modified. It consists mostly of a large depressed plate (plate xvii, fig. 7, *pl*) produced on each side into two ventrally projecting ridges divergent behind. The posterior border is free, above it is the external genital opening *(gc)*, a narrow transversely elongated aperture. It opens into a cavity, the genital chamber, situated above the plate. The structure is best studied by means of transverse and longitudinal sections. Longitudinal sections (plate xvii, fig. 6) show that the genital chamber *(gc)* is formed as an invagination of the sternum of the eighth abdominal segment, a short distance in front of the posterior border of the latter. The vagina *(v)* opens into the upper part of its anterior end by a terminal downward curvature. It is lined by a continuation of the chitinous wall of the body. Transverse sections (plate xvii, figs. 1-3) show that the depressed plate of the eighth abdominal sternum is W-shaped. The tergum of the segment forms a large, continuous, arched plate extending on each side to the lateral edge of the body. Here a non-chitinized line occurs, separating the tergum from a pleural chitinization situated laterally on the ventral aspect. The inner edges of these are united by unchitinized spaces with the outer arms of the W-shaped sternum. Each angle of this, again, is free from chitin. The lateral walls are thick and especially so at their bases, where they are produced into a large, inward-projecting ridge *(b)*. The non-chitinization of the angles of the sternum and of its union with the pleural sclerites makes it evident that it is formed to enlarge by a diverging of the sides of the lower angles when an egg passes into the genital chamber. The inner lining *(ci)* of the latter is thin but mostly chitinized. A large mass of transverse muscles *(tm)* surround the inner wall, being attached latterly to the walls of the sternum and their enlarged bases. Back of the vaginal opening their inner ends are attached to a longitudinal dorsal crest of the inner wall of the cavity. A few longitudinal muscles *(lm)* also are present.

The genital cavity is wide posteriorly but becomes narrower in front. It is almost divided into two longitudinal chambers by the dorsal ridge of the ventral groove of the sternum. The vagina opens into its anterior end somewhat to the right. This is a large tube and must be regarded as a part of the exterior since it possesses a chitinous intima continuous through that of the genital cavity with the exterior covering of the body. From the genital chamber the vagina (plate xvii, figs. 2–5, *vo*, *av*, *pv*, and *cv*) runs a short distance dorsally and then turns forward. It forms a large U-shaped tube (plate xvi, fig. 3, *va*) lying in the ventral part of the abdominal cavity, with the closed end reaching far forward. Sometimes it is somewhat spirally twisted upon itself. The anteriorly running arm begins at the anterior end of the genital cavity to the right of the other backward running arm (plate xvii, figs. 2, 3, 4, *vo*, *av*, *pv*). The latter is generally expanded near its middle but becomes narrower posteriorly, reaching back of the opening of the other arm into the genital chamber. Here it makes a bend to the right (plate xvii, fig. 1, *pv*) and becomes continuous with the oviduct (*od*).

The muscles surrounding the genital cavity are continuous over the vagina, forming circular muscles around it which continue throughout its whole length. Outside of these are a few transverse muscles. Grosse states that the muscles begin near the opening. Within the muscles is a structureless membrane which forms the true outer covering of the vagina. Within this is a cellular epithelium lined by a chitinous intima thrown into large folds projecting into the lumen.

The oviduct (plate xvii, figs. 1–6, *od*) is very long and somewhat coiled. It varies greatly in different specimens, but always runs forward from the anterior end of the vagina as an apparent continuation of it. It is first closely or openly bent upon itself, and then runs again forward to near the anterior end of the vagina, where it bifurcates, each tube running outward and backward, bearing at its end the egg-tubes of the same side. According to the specimen the oviduct may be very narrow or greatly distended. It is formed of the same elements as the vagina except that it lacks the chitinous intima. The inner ends of the epithelium cells (plate xvi, fig. 4, *ep*) project irregularly into the lumen, and the latter is generally almost obliterated by the approximation of the cells, which are much larger than those of the vagina. The muscle layers, on the other hand, are not so thick.

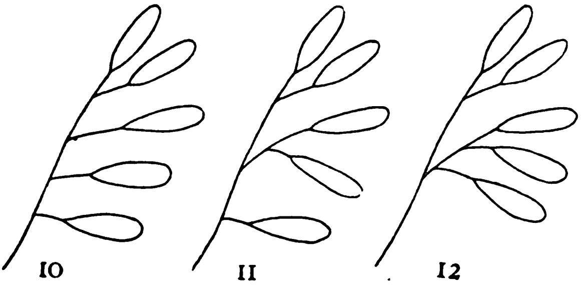
The egg-tubes are five in number on each side. They arise from the distal ends of the oviducts and have the same structure that they show except that the outer covering of muscles is lacking. Each is a long slender tube dilated where it contains ova into chambers which decrease in size distally. The five tubes on each side are united at their anterior ends and form a tangled mass on each side of the body. Each tube (plate xvi, fig. 6) is surrounded by a close, outer, structureless membrana propria (*mp*). Within this is an epithelium composed of a single layer of cells. When there is no egg present in the ovary these cells are all very large (plate xvii, figs. 3–5, *o*) and almost fill the lumen of each tube. They appear triangular in transverse sections, while their bases on the membrana propria are polygonal. A large, radially elongated nucleus is present in each. When ova are present in the ovaries the egg-tubes present a very different appearance (plate xvi, fig. 6). Each egg is surrounded by a follicle formed by an enlargement of the tubule. In the lower chambers (*a*) are to be found fully formed eggs (*o*). They are surrounded by a thick egg-covering filled with granular yolk. In form they are elongated and flattened at each end. The epithelium (*ep*) of the walls of a lowermost egg-chamber is composed mostly of small cubical cells. Posteriorly they are elongated, forming a transverse posterior wall for the chamber in the middle of which is the opening into the proximal part of the tubule connecting the egg-chambers with the oviduct. In front the epithelial cells become successively longer, until the most anterior are very long and slender, those from opposite sides almost meeting one another. In front of these are four immensely enlarged cells (*ac*) entirely filling the lumen of the tubule and thus closing the anterior end of the egg-chamber. These retain the form of the cells of an inactive tubule. The small epithelial cells are lined by a distinct intima, which is apparently absent when there is no egg present and the cells are large.

The smaller egg-chambers (*b*) contain a granular mass of yolk (*g*) which is not surrounded by a covering of its own. The epithelium is the same as in the lower chamber, except that the anterior cells are not elongated. Filling the anterior end of the enlargement of the tubule are six large cells. The part of the tubules connecting two egg-chambers is slender, with small epithelial cells.

Grosse states that there is present on each side of the vagina a club-shaped spermathæca. In the specimens of *Menopon titan* examined, however, there was no organ of this kind present.

In *Eurymetopus taurus* (plate xvi, fig. 1) the vagina *(va)* consists of a large, wide, straight, invaginated tube reaching forward to the fifth abdominal segment. Into its anterior end open two oviducts, one from each side. Into the posterior end on the dorsal side a duct opens, connected at its distal end with a large, dorsoventrally flattened, glandular organ *(g)*. The cells of this are very large and distinct (plate xvi, fig. 2). The duct is divided into a wide distal and narrower proximal part. The posterior end of the first is invaginated and the second part arises from the inner end of this. Numerous muscle-fibers *(m)* are attached to the upper part around its middle. Spermatozoa were not found in the gland. This appendage is constant, but the pouch referred to varies a great deal.

The oviducts are simple tubes extending outward, anteriorly and dorsally into the fourth segment. They are sometimes narrow tubes with enlarged bases and are sometimes wide throughout their whole length. Each bears at its distal end five egg-tubules. These sometimes join the oviduct serially as in fig. 10, or two or more may be united at their bases as shown in figs. 11 and 12.



Figs. 10–12.—Variations in attachment of egg-tubules to the oviduct in *Eurymetopus taurus*.

Nitzsch states that in the Ischnocera there are five egg-tubes present in the females, while in the Amblycera there are but three. He expresses a doubt though whether this second statement holds for the suborder. Rudow (1870) states that in both groups five are present but that in the Amblycera (*Liotheum*) two remain rudimentary. Even this statement is not entirely true, for there are five well developed in the adult *Menopon titan*. Sections of a young *Menopon persignatum* show four fully formed tubules and one small one. Adults of *Colpocephalum osborni* show three well developed and one small one on each side. In *Trinoton luridum* there are four in the adult. Grosse in his paper on the anatomy of *Tetrophthalmus chilensis* (*Menopon titan*) quotes Nitzsch's statements in regard to the number of egg-tubes, but adds no observations on the number present in the form he describes. Nitzsch figures the female organs of *Menopon mesoleucum*. According to him there is present a short, wide vagina, narrowed in front where it gives off on each side an oviduct. Each of these bears distally three egg-tubes. A double spermathæca opens into the base of the vagina. He figures also *Goniodes dissimilis*, in which the vagina is a straight tube branching in front into two rather wide oviducts into which open five egg-tubes. Into the posterior side of each duct three blind tubes open internal to the ovarian tubules. Kramer describes the female organs of *Lipeurus jejunus*, giving five as the number of egg-tubes present.

From the descriptions just given it is evident that the two suborders differ from each other in regard to the female organs simply in that there is a tendency amongst Amblyceran forms toward a reduction of the number of ovarian tubules from five—the constant number in the Ischnocera—to three.

The eggs (plate xvii, fig. 8) are large, oval, and generally rather elongated. They are attached to the bases of the feathers singly or in groups. On birds badly infested large numbers of eggs may be found. They are fastened by one end, having that end from which the embryo will emerge directed toward the tip of the feather. When the embryo leaves the egg it pushes off a circular cap and partly protrudes itself. In *Docophorus fuliginosus* the embryos apparently remain in the mouth of the open egg for some time, for many were found in this position. Some found thus were very immature (plate xvii, figs. 9 and 10), having the mandibles entirely unchitinized, the maxillæ almost as large as the mandibles, and the labium large, consisting of a transverse basal position and two lateral lobes. The most immature of those found free from the egg had the mandibles well chitinized.

Little has been done on the embryology of the Mallophaga. The work of Nusbaum (1882) on the development of the reproductive organs has already been referred to. Melnikow (1869) made a more general study of the embryology, but since he concluded from his investigations that the Mallophaga are closely related to the Pediculidæ—a conclusion entirely untenable—his work cannot be very accurate. He proves that there is present a beak but no labium, and hence that the mouth-parts are Hemipteran!

VII. SUMMARY.

The foregoing descriptions of the various systems of organs of the Mallophaga show that the two suborders are separated by wide structural differences. These may be tabulated as follows:

Amblycera.	*Ischnocera.*
Mesonotum and Metanotum Distinct.	**Mesonotum and Metanotum Fused.**
Antennæ concealed.	Antennæ exposed.
Antennæ clavate.	Antennæ not clavate.
Mandibles horizontal.	Mandibles vertical.
Labial palpi present.	Labial palpi absent.
Paraglossæ various in form.	Paraglossæ constant in form.
Œsophageal sclerite and connected glands absent or modified.	Œsophageal sclerite and connected glands present and normal except in a few scattered cases.
Crop simple.	Crop an œsophageal diverticulum.
Salivary glands various in form.	Salivary glands constant in form.
Ingluvial glands absent.	Ingluvial glands present.
Testes six.	Testes four.
Chitinous ♂ genitalia simple.	Chitinous ♂ genitalia more complex.
Egg-tubes three to five.	Egg-tubes five.

The above table shows that in nearly every character in which the two suborders differ the Ischnocera have a more specialized organization. That the separation of the two groups is very great is shown by the fact that nearly all the important organs are affected, the heart, tracheal system, and nervous system being the only ones alike in both. The exact systematic position of the Mallophaga cannot at present be determined, since enough of the anatomy of nearly related forms is not known. Packard (1887), however, has shown that they may be closely related to the Psocidæ, and Kellogg (1896) has given further evidence of this. But if the Psocidæ are the most closely associated with the Mallophaga, in what manner the two groups are related is impossible to say. Until this is known the relationship of the two suborders of the Mallophaga to each other cannot be determined nor that of the families composing these suborders.

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EXPLANATION OF PLATES.

PLATE X.—Fig. 1, Median dorsoventral longitudinal section of anterior half of *Menopon titan; h* head, t_1 prothorax, t_2 mesothorax, t_3 metathorax; a_1 first abdominal segment, a_2 second abdominal segment, *bw* outer body-wall, *bm* basement membrane, *m* mouth-opening, *bc* buccal cavity, *p* pharynx, *œ* œsophagus, *cr* crop, *v* anterior end of ventriculus, *sg* salivary gland, *b* brain, *s.œ. g* subœsophageal ganglion, g_1 prothoracic ganglion, g_2 mesothoracic ganglion, g_3 metathoracic ganglion, *tr* trachea, *lm* longitudinal muscle, *tm* transverse muscle, *o* anterior end of an egg-tube cut near the surface. Fig. 2, Throat skeleton with attached glands of *Eurymetopus taurus; œ. s* œsophageal sclerite, *l. g* glands, *d* duct, *ch. ped* chitinous pedicle. Fig. 3, Left maxilla, ventral aspect, of *Goniodes cervinicornis.* Fig. 4, Labial fork of *Ancistrona gigas.* Fig. 5, Mandibles, ventral aspect, of *Ancistrona gigas.* Fig. 6, Mandibles, posterior aspect, of *Goniodes cervinicornis.* Fig. 7, Œsophageal sclerite, dorsal aspect, of *Eurymetopus taurus; d* duct, *do* opening of duct, *m* median groove, *ant. p.* anterior process, *c. œ* circumœsophageal process. Fig. 8, Hypopharynx of *Ancistrona gigas.* Fig. 9, Labium of *Nitzschia dubius; sm* submentum, *m* mentum, *pf* palpifer, *lp* labial palpus, *g* glossa, *pg* paraglossa. Fig. 10, Right maxilla, ventral aspect, of a *Læmobothrium.* Fig. 11, Mandibles, ventral aspect, of *Læmobothrium* sp.; *c* condyles, *r* right mandible, *l* left mandible. Fig. 12, Right mandible, posterior aspect, of *Goniodes cervinicornis; c* condyle, *ch pls* chitinous plates. Fig. 13, Labium, ventral aspect, of *Eurymetopus taurus; sm* submentum, *m* mentum, *g* glossa, *pg* paraglossa.

PLATE XI.—Fig. 1, Salivary glands of *Trichodectes geomydis; a* outer gland, *b* inner gland. Fig. 2, Salivary organs of *Menopon titan* (after Grosse); *a* salivary gland, *b* saliva reservoir. Fig. 3, Large-celled salivary gland of *Trichodectes geomydis,* with the cells in natural position; *d* duct. Fig. 4, Same as last but with cells spread apart showing branches of duct (*d*) to individual cells. Fig. 5, Large-celled gland of *Eurymetopus taurus; d* duct. Fig. 6, Longitudinal section of part of Malpighian tubule of *Menopon titan: mp* membrana propria, *ep* epithelium, *in* intima. Fig. 7, Part of alimentary canal with Malpighian tubules of *Colpocephalum osborni; v* lower end of ventriculus, *i* upper end of intestine. Fig. 8, Alimentary canal of *Docophorus lari.* Fig. 9, Crop (*cr*) with part of œsophagus and ventriculus of a *Trichodectes* from a horse. Fig. 10, Alimentary canal of *Trichodectes geomydis; g* large-celled glands of crop. Fig. 11, Alimentary canal of *Eurymetopus taurus,* ventral view; *r* outer salivary gland or saliva reservoir, g_1 inner gland, g_2 large-celled gland. Fig. 12, Alimentary canal of *Goniodes cervinicornis.* Fig. 13, Alimentary canal of *Menopon titan.*

PLATE XII.—Transverse sections of *Menopon persignatum*. Fig. 1, Section through head in region of anterior end of brain. Fig. 2, Section through head in region of posterior part of antennary fossæ. Fig. 3, Section through head, passing through the eyes. Fig. 4, Section through posterior part of head. Fig. 5, Section through prothorax just back of the legs. Fig. 6, Section of mesothorax through bases of the legs. Fig. 7, Section of metathorax just in front of the legs; *œ* œsophagus, *an* antenna, *br* brain, *sg* subœsophageal ganglion, *e* eye, *tr* trachea, *h* heart, *l* base of mesothoracic leg, *f* fat-body, *cr* crop, g_1 prothoracic ganglion, g_2 mesothoracic ganglion, *c* nerve commissure in front of mesothoracic ganglion, *vw* thickened ventral wall of antennary fossa.

PLATE XIII.—Internal male genitalia. Fig. 1, Transverse section of testis of *Menopon titan; mp* outer tunica, *ep* epithelium. Fig. 2, Transverse section of vas deferens of *Menopon titan; mp* membrana propria, *ep* epithelium, *in* intima. Fig. 3, Reproductive organs of male *Goniodes cervinicornis; t* testes, *vd* vas deferens, *sv* vesiculæ seminales, *ej* ductus ejaculatorius. Fig. 4, Transverse section of ductus ejaculatorius of *Menopon titan; mp* membrana propria, *ep* epithelium, *in* intima, *m* circular muscles. Fig. 5, Transverse section of lower end of vesicula seminalis of *Menopon titan;* letters as in last. Fig. 6, Transverse section through middle of vesicula seminalis of *Menopon titan;* letters as in fig. 4. Fig. 7, Reproductive organs of male *Colpocephalum flavescens* (after Nitzsch); *t* testes, *vd* vas deferens, *sv* seminal vesicle, *ej* ductus ejaculatorius, *r* chitinous rod attached to inner tube of genital cavity. Fig. 8, Same of *Eurymetopus taurus;* letters as before. Fig. 9, Same of *Physostomum diffusum;* letters as before. Fig. 10, Same of *Menopon titan;* letters as before, but also, *ve* vas deferens, *cd* transverse duct connecting the two vasa deferentia, *int* innermost invaginated tube of genital cavity, having rod (*r*) attached to its lower end.

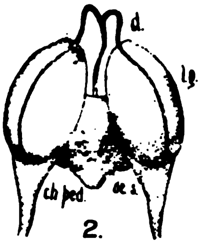
PLATE XIV.—External male genitalia. Fig. 1, Chitinous genital parts of *Lipeurus fuliginosus major*, dorsal aspect. Fig. 2, Same of *Goniodes cervinicornis*, dorsal aspect. Fig. 3, Same of *Physostomum diffusum*. Fig. 4, Same of *Giebelia mirabilis*. Fig. 5, Same of *Eurymetopus taurus*, dorsal aspect. Fig. 6, Same of *Colpocephalum osborni*. Fig. 7, Same of *Trinoton luridum*. Fig. 8, Same of *Docophorus lari*. Fig. 9, Same of *Goniocotes creber*. Fig. 10, Same of *Menopon mesoleucum*.

PLATE XV.—Fig. 1, Longitudinal section of two posterior somites of male *Eurymetopus taurus*. Fig. 2, Longitudinal section of six posterior segments of male *Menopon titan*. Figs. 3–5, Transverse sections of abdomen of male *Menopon titan*. Fig. 3, Through anterior end of segment VIII. Fig. 4, Through segment VII. Fig. 5, Through segment V; *tm* transverse muscles; *lm* longitudinal muscles, *em* extrusor muscles, *m* membrane surrounding muscles, *gc* genital chamber, *i* intestine, *a* anus, *p* penis, *pl* internal plate, *r* internal rod, t_1 outermost invaginated tube,

t_2 middle tube, t_3 innermost tube, *re* anterior recurved edges of outer and middle tubes, *t* testes, *vd* vas deferens, *sv* seminal vesicle, *ej* ejaculatory duct, *vp* ventral plate to which transverse muscles are attached, *mt* Malpighian tubule, *f* fat-body, *tr* trachea, *tg* tergum, *s* sternum, *p* pleuron.

PLATE XVI.—Fig. 1, Reproductive organs of female *Eurymetopus taurus*; *o* ovaries, *od* oviduct, *va* vagina, *sp* spermathæca, *g* gland. Fig. 2, Accessory gland of female *Eurymetopus taurus*; *d* duct, *m* attached muscles. Fig. 3, Reproductive organs of female *Menopon titan*; *o* ovaries, *od* oviduct, *va* vagina. Fig. 4, Transverse section of oviduct of *Menopon titan*; *ep* epithelium, *m* circular muscles, *mp* membrana propria. Fig. 5, Detached egg-cap (See plate xvii, fig. 8). Fig. 6, Longitudinal section through an egg-tube of *Menopon titan; a* lowermost egg-chamber containing a mature egg (*o*), *b* an upper egg-chamber containing an immature egg (*g*), *ep* small epithelial cells forming side-walls of egg-chambers, *ac* very large epithelial cells filling the anterior ends of egg-chambers, *mp* membrana propria, *in* intima, *od* oviduct. Fig. 7, Nervous system of *Eurymetopus taurus*; *b* brain, *sg* subœsophageal ganglion, g_1 prothoracic ganglion, g_2 mesothoracic ganglion, g_3 metathoracic ganglion, *tr* trachea. Fig. 8, Longitudinal dorsoventral section of brain (*b*) and subœsophageal ganglion (*sg*), passing through the circumœsophageal commissure of *Menopon titan*; *fg* frontal ganglion.

PLATE XVII.—Figs. 1–5, Transverse sections through posterior end of abdomen of female *Menopon titan*, from behind forward: Fig. 1, through middle of genital cavity (*gc*); Fig. 2, through the beginning of the vagina (*vo*); Fig. 3, cut in front of vaginal opening; Fig. 4, taken in front of genital cavity; Fig. 5, through anterior end of vagina; *r* rectum, *rg* rectal glands, *tr* trachea, *f* fat-body, *gc* genital cavity, *tm* transverse muscles, *lm* longitudinal muscles, *ci* inner chitinous wall of genital chamber, *b* enlarged base of outer chitinous wall of genital chamber, *vo* vaginal opening into anterior part of genital chamber, *av* anteriorly running part of vagina, *pv* posteriorly running part of vagina, *cv* anterior end of vagina where the two arms meet, *o* egg-tubes, *pr* prerectal part of intestine, *od* sections through the coils of the oviduct. Fig. 6, Longitudinal dorsoventral section of five posterior abdominal segments of female *Menopon titan; bw* chitin wall of body, *bm* basement membrane, *m* longitudinal muscles, *a* anus, *r* rectum, *rtm* transverse muscles of rectum, *ch* chitinous lining of rectum, *rg* rectal glands, *gc* genital chamber, *v* vagina, *vtm* transverse muscles of vagina, *od* sections of oviduct. Fig. 7, Ventral view of posterior end of abdomen of female of *Menopon titan;* VII, VIII, IX, X segments of abdomen, *pl* plate forming ventral wall of genital cavity, *gc* opening of genital cavity to exterior. Fig. 8, Three eggs attached to shaft of a feather; *a* egg containing an embryo, *b* empty egg with cap off. Figs. 9 and 10, Young nymphs just hatched; *lb* labrum, *mn* mandible, mx_1 maxilla, mx_2 labium, *an* antenna, *m* mouth-opening.



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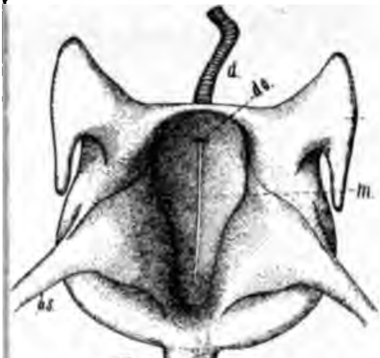

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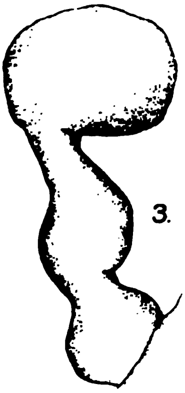

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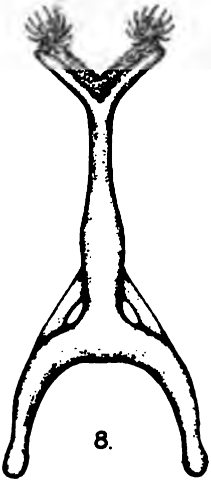

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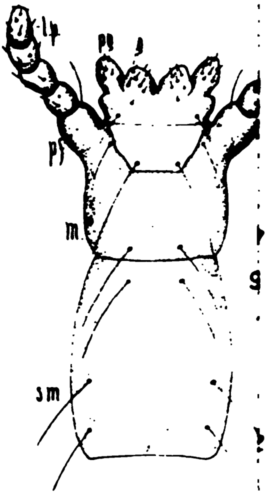

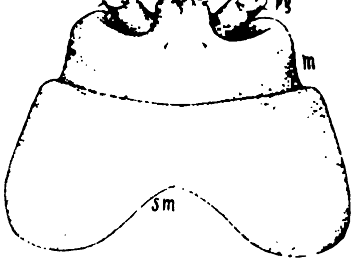

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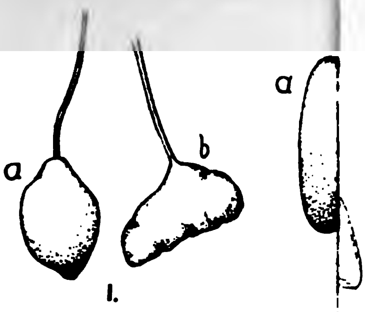

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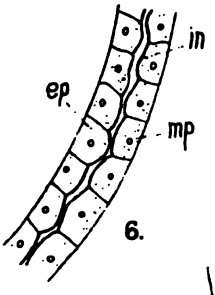

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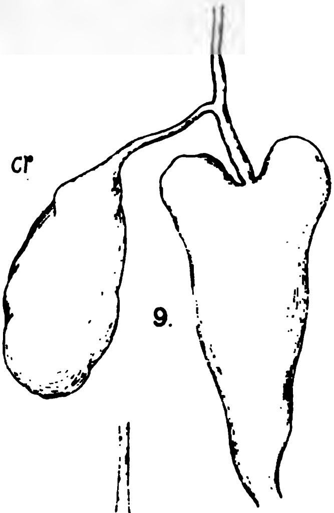

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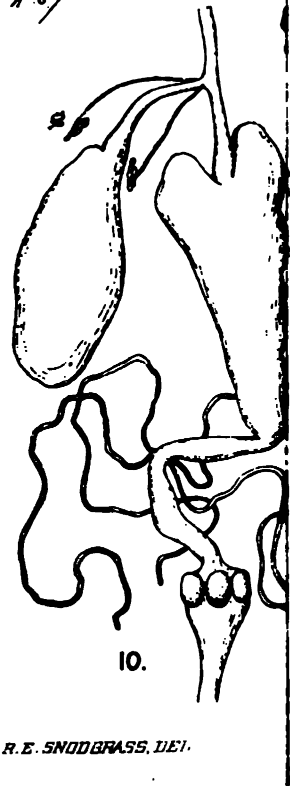

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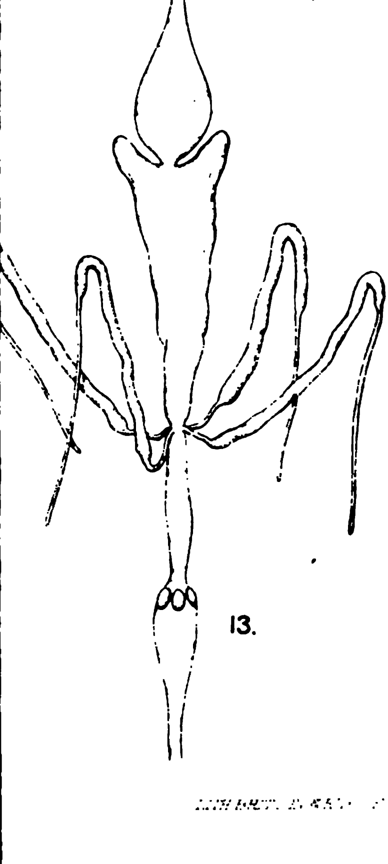

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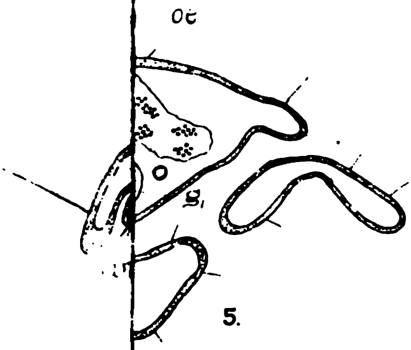

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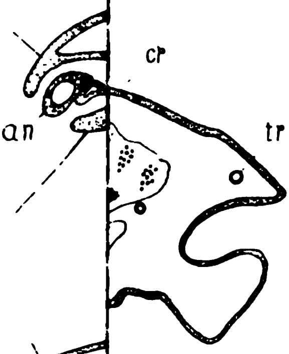

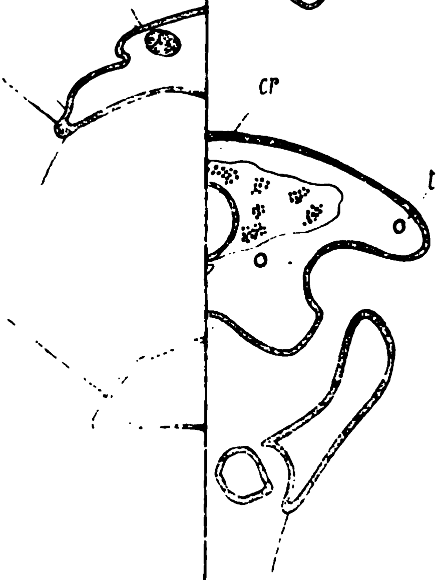

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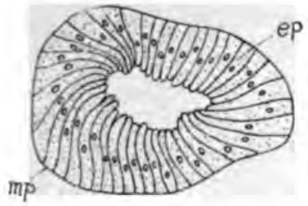

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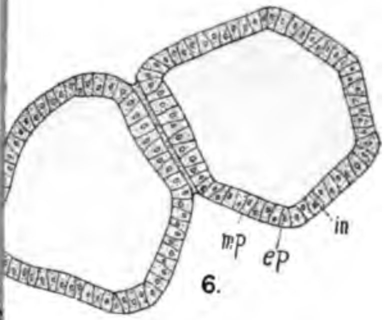

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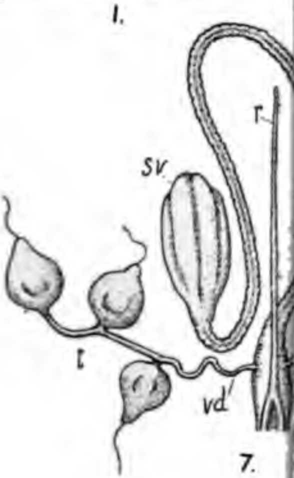

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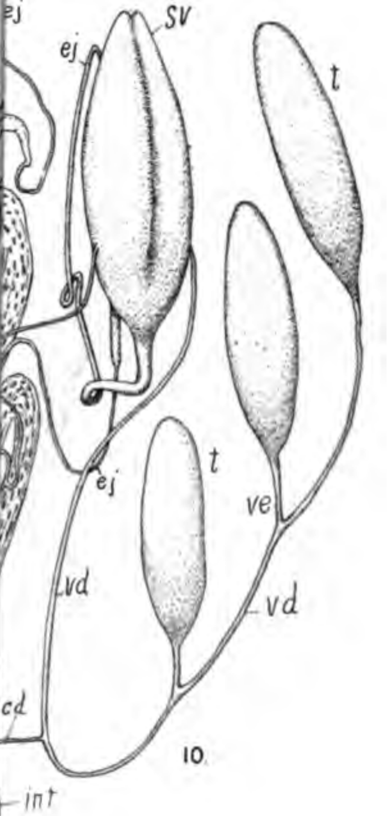

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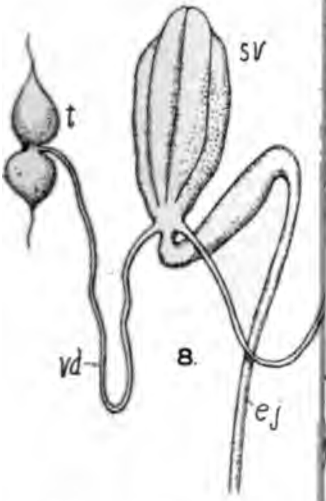

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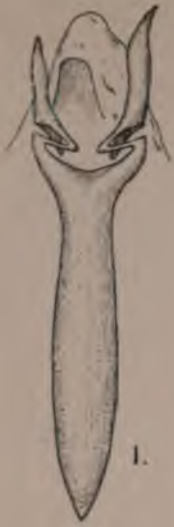
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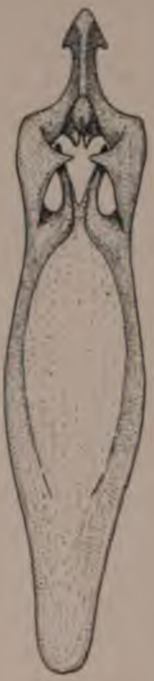
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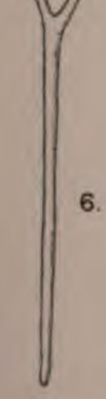
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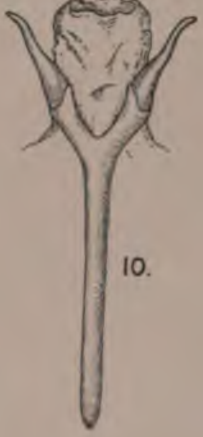
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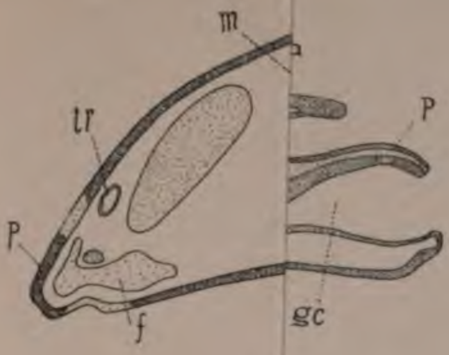

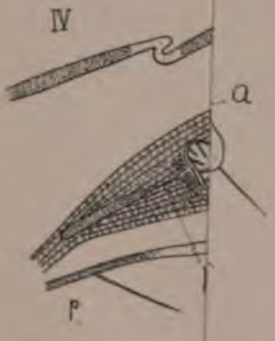

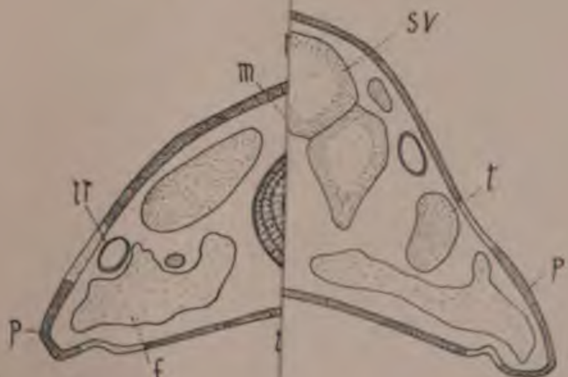

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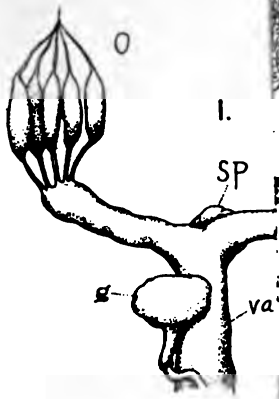

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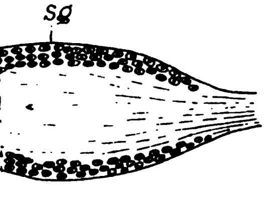

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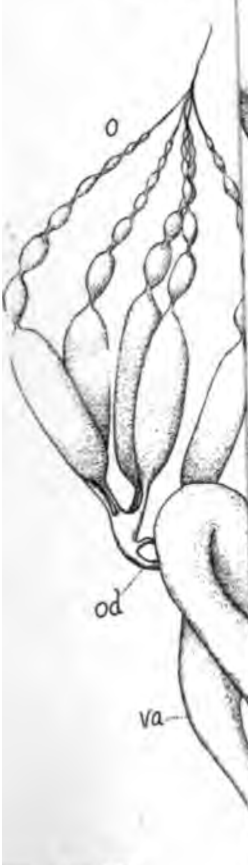

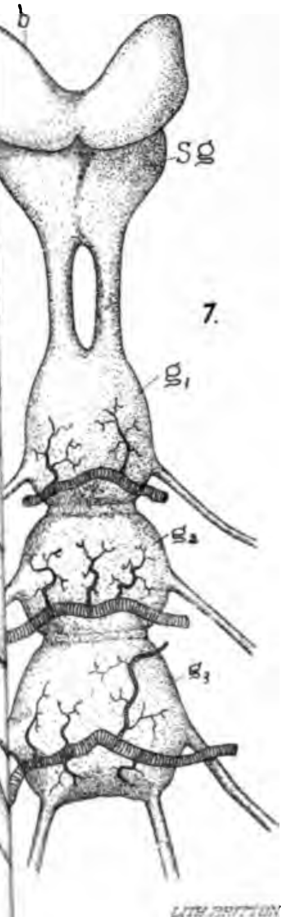

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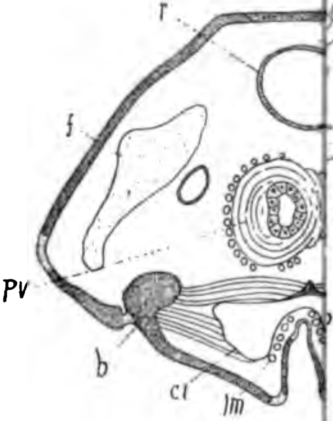
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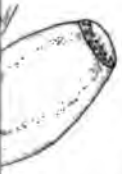

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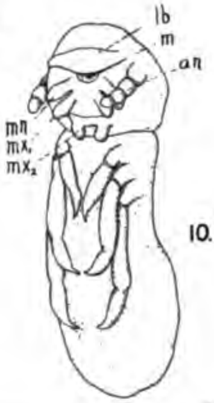
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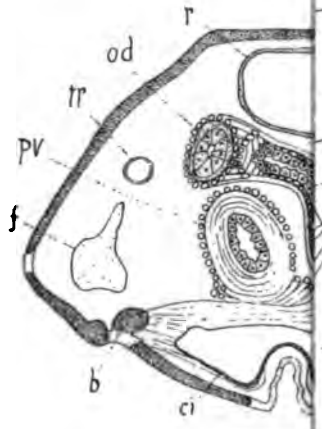
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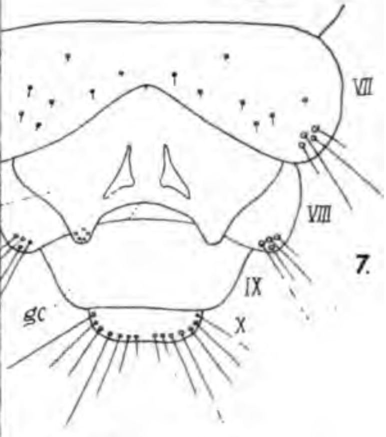
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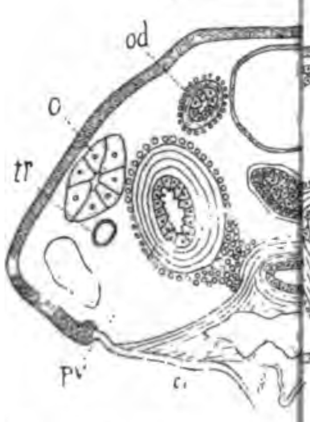
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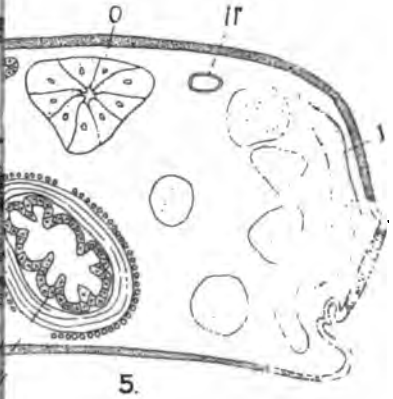
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SYNOPSIS

OF

California Stalk-Eyed Crustacea

BY

SAMUEL J. HOLMES

Issued June 15, 1900

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PREFACE.

The aim of the present paper is to give descriptions of the species of Stalk-eyed Crustacea which are found on the west coast of the United States. For the benefit of students of natural history, who have at present few readily accessible means of identifying the invertebrate animals of this coast, definitions of genera and higher divisions have been inserted, and a description given, in the Introduction, of those parts of the structure of the Decapod Crustacea which are most used for the purpose of classification. The endeavor has been made to enable those who have not previously studied the Crustacea to determine the specific names of the forms here described. The rules of nomenclature of the American Ornithologists' Union have been followed, except in case of the canon, not insisted on by the framers of the code, that specific names derived from the names of persons be written with a small letter. Localities from which I have examined specimens have usually been indicated by the note of exclamation, !.

The larger portion of this paper was completed at the University of California in 1895, but it has received some additions and considerable revision since that date. I wish to express my indebtedness to Prof. Wm. E. Ritter of the University of California for many favors in connection with my work, and to Dr. H. P. Johnson and Dr. F. W. Bancroft for several valuable specimens and for assistance in many other ways. Through the kindness of Dr. Gustav Eisen I have had the privilege of studying the collections of Crustacea in the California Academy of Sciences. The examination of Mr. Lockington's type specimens, many of which are in the possession of the Academy, has made it possible to straighten out some questions which otherwise would scarcely have been capable of solution. To Mr. Rivers and Mr. Harford, formerly of the University of California, I am indebted for the privilege of studying the collections in the University museum. From Miss Mary J. Rathbun and Dr. James E. Benedict of the U. S. National Museum much valuable aid has been received which is gratefully acknowledged.

S. J. HOLMES.

UNIVERSITY OF MICHIGAN,
Ann Arbor, Mich.
January 20, 1900.

SYNOPSIS OF CALIFORNIA STALK-EYED CRUSTACEA.

BY SAMUEL J. HOLMES.

INTRODUCTION.

THE Crustacea are commonly divided into two principal groups, the Malacostraca and the Entomostraca, although the primary divisions of the latter group may well be, as they often are, considered coördinate with the former. There is such great diversity of form among the Entomostraca that the group is scarcely definable except by negative characters. The number of segments composing the body is very variable and the openings of the genital ducts do not occur in the same segment in all the members of the group. There is no masticatory stomach and corresponding appendages are modified in most diverse ways in different orders. The Malacostraca, on the other hand, while they include a great variety of forms, constitute a well defined subclass. Except in cases in which it is quite evident that certain segments are fused or lost, the body is composed of twenty (or in *Nebalia* of twenty-one) segments. The typical number of appendages is nineteen. There is a pair of compound lateral eyes, and the stomach, except in a few parasitic species, is masticatory. The genital ducts of the male open on the last thoracic segment; those of the female on the antepenultimate one. The head is typically composed of five segments and the thorax of eight, some or all of which may fuse with the head forming a more or less complete cephalothorax. The abdomen is sharply marked off from the thorax and consists of seven (in *Nebalia* of eight) segments, all of which, except the last, the telson, may bear articulated appendages.

The Malacostraca may be divided as follows:—

Body composed of 21 segments and furnished with a bivalve shell. *Leptostraca.*

Body composed of 20 segments and not furnished with a well defined carapace. Eyes sessile.......... .... *Arthrostraca.*

Body composed of 20 segments and furnished with a well developed carapace which is never bivalved.................... *Thoracostraca.*

SYNOPSIS OF THE THORACOSTRACA.

Eyes sessile... *Cumacea.*

Eyes stalked.

- Carapace rather small, not covering all of the thoracic segments. The thoracic feet dissimilar, the anterior ones devoid of exopods. *Stomatopoda.*
- Carapace covering some or all of the thorax but not joined to the posterior segments. Thoracic feet usually similar, biramous. *Schizopoda.*
- Carapace covering and joined to all of the thoracic segments. The three anterior thoracic feet generally biramous and modified into mouth-parts.................................... *Decapoda.*

As it is with the Decapoda that we are here mainly concerned, those parts of the structure of these animals which are most used for the purpose of classification will be briefly described. The exoskeleton of a Decapod crustacean may be considered as a series of rings, each of which, with the exception of the last, is typically furnished with a pair of articulated appendages. These rings and their appendages are modified in various ways in different regions of the body in relation to the different functions they are called upon to perform.

The segments in some parts become fused together so completely that they manifest no external signs of metamerism except the appendages they carry. The five segments forming the head are usually thus indistinguishably fused. The eight following segments, with the rare exception of the last one, are fused together and with the head, forming the cephalothorax; but the sutures between the rings are, in this case, generally visible on the ventral, or sternal surface and at the sides. The abdomen is, in all cases, clearly marked off from the thorax, and is typically composed of seven segments. The number of joints may, however, be secondarily reduced by the concrescence or disappearance of some of the rings.

The Carapace.—The carapace of the Decapod crustacea is considered to be a fold of the dorsal integument of one or more of the cephalic segments which extends backward over, and fuses with the dorsal portion of all of the thoracic segments and is produced downwards at the sides over the gills. The form of the carapace commonly found in the Macroura is shown in the following cut:—

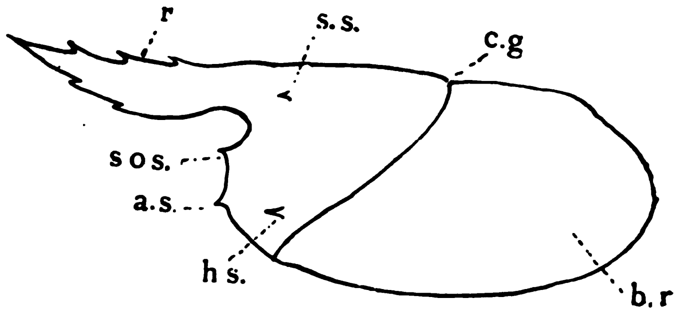

Fig 1.—Macrouran Carapace. *a. s*, antennal spine; *b. r*, branchial region; *c. g*, cervical groove; *h. s*, hepatic spine; *r*, rostrum; *s. o. s*, suborbital spine; *s. s*, supraorbital spine.

The typical Macrouran carapace is elongated, and the anterior end is produced into a rostrum. The anterior region of the carapace is often furnished with teeth or spines which occur in the following positions: the supra- ital spine, or spines, above the orbit; the suborbital ne on the anterior margin of the carapace below the [illegible] the antennal spine below the last and behind ba of the anten [illegible] th [illegible] atic spine on the he- [illegible] n. Any or [illegible] spines may be present [illegible] ent. There is [illegible] erally [illegible] sible a groove, known the cervical groove, which e tends downwards and rwards from the dorsal surf [illegible] f the carapace, marking the line of union of the [illegible] ad and thorax. The dorsal surface in front of this groove is termed the gastric region, the hepatic reg [illegible] s lying at the sides; immediately behind the gastr [illegible] region is the cardiac, while the intestinal region lies behind the latter at the posterior end of the carapace; the sides of the carapace behind the cervical groove are known as the branchial regions, since they form a covering for the branchiæ, or gills.

In the Brachyura the carapace is wide and generally flattened, and the rostrum is small or absent. The regions are generally separated from each other by sulci, or grooves, and there are usually more regions marked out than in the Macroura. The cervical groove is usually visible and divides the gastric and hepatic from the cardiac and branchial regions. On the sides of the carapace below the lateral margins there are (1), the pterygostomian region on either side of the mouth area and (2), the sub-branchial regions below the branchial areas. The names of the regions which appear on the dorsal surface may be obtained from fig. 2. The distinctness of these areas is subject to great variation in different forms. In some cases the outlines of all the regions are very clear, while in others they may be entirely obliterated. Other areas are sometimes given names but they are of little importance.

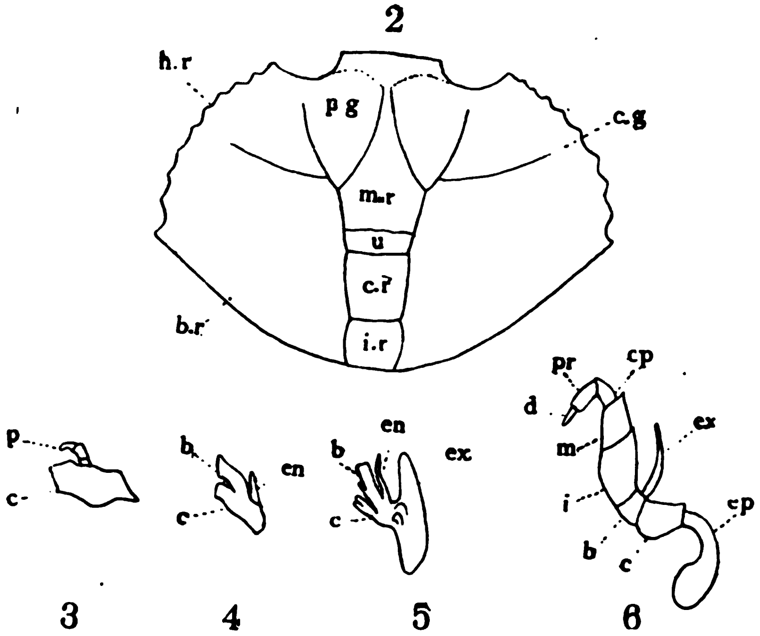

Fig. 2.—Carapace of a crab. 3.—Mandible of a crayfish. 4.—First maxilla. 5.—Second maxilla. 6.—Third maxilliped. *b*, basipodite; *b. r*, branchial region; *c*, coxopodite; *c. g*, cervical groove; *cp*, carpus; *c. r*, cardiac region; *d*, dactyl; *en*, endopodite; *ep*, epipodite; *ex*, exopodite; *h. r*, hepatic region; *i*, ischium; *i. r*, intestinal region; *m*, merus; *m. r*, mesogastric region; *p*, palp; *p. g*, protogastric areas; *pr*, propodus; *r*, rostrum; *u*, urogastric area.

THE APPENDAGES.

With the exception of the eyes and the first pair of antennæ all of the appendages of a Decapod crustacean may be considered modifications of a common type consisting of a basal portion, the protopodite, and two terminal rami. The first basal joint, the coxopodite, or coxa, usually bears a branchial appendage, or epipodite; the second joint, the basipodite, carries the two rami; the inner ramus is called the endopodite, the outer the exopodite. In the Decapods the endopodite of the thoracic appendages is typically composed of five joints which, counting from the basipodite, are designated as the ischium, merus, carpus, propodus, and dactyl. In the appendages which precede and in those which follow the thorax the endopodite is undivided, or composed of less than five true joints. The appendages will be described in their order from before backwards.

The Eyes and Orbits.—The eyes in all of the Decapods are compound and situated at the end of movable stalks. These stalks, however, are probably not homologous with the other appendages. The orbits in the Macroura are generally represented by excavations in the anterior margin of the carapace, but in the Brachyura they form well defined cavities into which the eye-stalks can be withdrawn. The number and position of the orbital fissures are important characters for the purpose of classification.

The First and Second Antennæ.—The first antennæ, or antennules, unlike the succeeding appendages, are not typically biramous. It is true that they may bear two terminal branches, or in some of the lower Macroura even three, but it is quite clear that this condition is a secondary one. The basal portion, or peduncle, normally consists of three joints, in the first of which is located the auditory organ. In the Brachyura the antennules are small, and located in cavities called fossettes.

The second antennæ are usually larger than the first pair and situated behind or external to them. The exopod is represented by a scale, or acicle, attached to the second basal joint, but this structure is often absent, especially in the higher forms. The peduncle usually contains four or five joints and bears an annulated, terminal portion, the flagellum. The first joint contains the opening of the renal organ and is often immovably joined to the carapace.

The Mandibles.—The appendages which function as mandibles are highly modified. The first joint (coxopodite) is enlarged and modified for the purpose of mastication; this part is called the trunk and its inner edge is generally dentate and often divided into a lower portion, or molar process, and an upper cutting edge. The trunk bears a jointed appendage, or palp, which, in this group, never consists of more than three joints.

The First and Second Maxillæ.—The first maxillæ are always small and foliaceous. The two basal joints are flattened and produced inward; there is a small endopodite; the exopodite is usually absent. In the second maxillæ the two basal joints are modified much like those of the first pair. There is a small endopodite outside of which is joined a large, flattened appendage (exopodite, scaphognathite) which serves to produce a current of water from the branchial chamber.

The First Maxillipeds.—These are the first thoracic appendages. The two basal joints are flattened and produced, forming the so-called laciniæ, or masticatory ridges. The endopod is small and generally joined to a greater or less extent to the exopod; the latter is well developed and ends in an annulated, terminal portion, or palp.

The Second Maxillipeds.—The second maxillipeds are more like the third pair than the first; the endopod is well developed and generally contains the typical number (five) of joints. The exopod is also well developed and furnished with a terminal palp. The epipod often bears one or more gills.

The Third Maxillipeds.—The endopod of the third maxillipeds is usually composed of five joints. In the Brachyura the ischium and merus are flattened and generally fitted neatly to the buccal area; the last three joints are small and are termed the palp; in the Macroura the joints of the third maxillipeds are usually rounded. The exopod may be well developed, but is sometimes wanting.

The Thoracic Legs, or Pereopods.—The thoracic legs, with rare exceptions, consist of seven joints, two or more of which are generally fused together. The exopod is wanting, except in some of the lower Macroura, where it is represented by a small, jointed appendage. One or more of the thoracic legs may be furnished with pincers or chelæ, in which case they are called chelipeds; the movable finger of the hand, or chela, is called the dactyl, the immovable one the pollex; the basal portion of the hand is known as the palm.

The Abdominal Appendages, or Pleopods.—The pleopods in the Macroura are generally furnished with flattened rami adapted for swimming; the posterior pair is usually much larger than the others and forms with the telson a strong tail fin. In the Brachyura these appendages are never employed in swimming; in the females they are used for holding the ova; in the males only one or two of the anterior pairs are retained as sexual appendages and these are sometimes wanting.

The Gills.—The gills may be situated on the basal joints of the thoracic appendages (podobranchiæ), or on the articular membranes between the legs and the body (arthrobranchiæ), or on the sides of the thoracic segments (pleurobranchiæ). There are two types of gills—the trichobranchiæ, in which there are thread-like, branchial filaments arranged around a common stem, and the phyllobranchiæ, in which the stem bears on each side a row of thin, transverse lamellæ.

A few other structures deserve mention in this connection, viz.:—the *epistoma*, the area lying in front of the buccal, or mouth area and behind the antennules; the *upper lip*, a fleshy projection in front of the mandibles; the *lower lip*, a flap lying behind the mandibles; the *thoracic sternum*, or *sternal plastron*, the ventral portion of the thorax, and the terminal segment of the Macrouran abdomen, the *telson*.

Tribe BRACHYURA.

Carapace broad. Orbits well defined. Antennules lodged in fossettes. Antennæ short and devoid of an acicle. The external maxillipeds have the ischium and merus flattened and usually fitted neatly to the buccal area. First pair of legs always chelate; the following pairs always simple. The abdomen is small, shorter than the carapace, and flexed against the ventral surface of the thorax. The abdomen of the male is smaller than that of the female and bears but one or two pairs of appendages near the base; abdominal appendages in the female more numerous than in the male and used for holding the ova. Tail fin absent.

The subdivisions of the Brachyura can usually be recognized by their general form. The Maioidea, or spider crabs, have the carapace narrowed in front where it is generally produced into a rostrum. The Cancroidea usually have a transverse carapace with a narrow front. The Grapsoidea may commonly be recognized by their quadrate form, but there are many forms which do not exhibit this character. The Oxystomata may be distinguished by the form of the buccal area which is narrowed in front. None of these marks, however, are absolutely diagnostic, for it is difficult to separate the groups by single characters.

Subtribe MAIOIDEA, or OXYRHYNCHA.

Carapace narrowed in front and usually furnished with a rostrum Branchial regions large; hepatic regions small. Buccal area quadrate. Epistoma usually large. The afferent channels open behind the pterygostomian regions in front of the chelipeds; efferent channels opening at the sides of the endostome. Antennules longitudinally plicated. Palp of the maxillipeds situated at the summit or antero-internal angle of the merus. Verges of the male on the coxæ of the last pair of legs.

This group includes the species known as the "spider crabs" and "sharp-nosed crabs." They are generally of sluggish habit and many of the species become overgrown with sea-weeds and other foreign growths, which make them difficult to detect in their natural habitat.

The classification followed is that given in Miers' revision of this group.[1]

Legion MAIINEA.

Basal joint of the antennæ well developed and inserted beneath the eyes, usually occupying a great part of the infra-orbital space.

Family INACHIDÆ.

Orbits not defined. Preorbital and postorbital spines generally well developed. Eyes not retractile, or retractile against the sides of the carapace. Basal antennal joint generally slender. Rostrum simple or bifid. Fingers of the chelæ never excavated at the tips.

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[1] Jour. Linn. Soc., London, Vol. XIV, 1879.

Subfamily LEPTOPODIINÆ.

Eyes slender, not retractile, laterally projecting. Preocular and postocular spines small or wanting. Basal joint of the antennæ slender throughout its length. Rostrum usually simple.

Genus **Podochela** *St.*

Carapace depressed, narrowly triangular, strongly produced in front. Gastric region narrow, tumid, rostrum short, entire, triangular or arcuate. Eyes long and laterally projecting. Basal antennal joint narrow, with a median, longitudinal groove; the apex narrow and not dentate. Flagellum slender and visible from above. Merus of external maxillipeds much shorter than the ischium, the apices obtuse or produced, the inner one more or less incised; palp joined at the summit of the merus. Epistome very long. Chelipeds of moderate size; merus curved, the margins ciliated. Ambulatory legs very long, subprehensile, and often furnished with a more or less cheliform hand. Dactyls of chelipeds very slender and often hooked, those of the remaining legs falciform. Sternum of female deeply concave and surrounded by a laminate margin. First abdominal segment quite large, second, third, and fourth very short; the last two or three segments fused together.

Type.—P. grossipes St.

Podochela Hemphillii (*Lock.*)

Microrhynchus Hemphillii Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 30.

Inachoides (Microrhynchus) Hemphillii Lockington, l. c., p. 75.

Podochela tenuipes Rathbun M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 224.

Podochela Hemphillii Rathbun M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 569.

Carapace pyriform; gastric region prominent, rounded, and bearing tufts of curved setæ; hepatic regions tumid, bearing two pointed tubercles, the larger one above and in front of the smaller; cardiac region separated by shallow grooves from the branchial and bearing a prominent elevation; branchial regions flattened or tumid. Rostrum triangular, acute, and bearing two double rows of curved setæ above; it varies considerably in length, being sometimes broadly and sometimes narrowly triangular. The area between the two projecting rims of the orbits is concave. There is no tooth at the posterior margin of the orbit, but there may be a small one a short distance behind it. Eye-stalks constricted at the middle and bearing a few setæ at the subacute tip. Basal antennal joint with a longitudinal ridge on its posterior half or two-thirds with a groove on either side. Ischium of maxillipeds with a shallow, longitudinal groove; merus narrower than ischium, the internal angle produced, and the surface strongly concave from side to side. Chelipeds in the male robust; merus incurved and having an outer spiny ridge; carpus with a posterior spine on the upper side; hand oblong, incurved, palm inflated, fingers gaping the base and meeting along the distal half, or two-thirds of their gth; there are generally several small, spiny projections on the surface of the hand which are more conspicuous along the edges, especially the female the chelipeds are smaller and more slender, the rical, and the fingers nearly straight. Legs very long and urnished with tufts of long setæ, those on the upper side curved; dactyls slender, falciform, those of the first pair about one- the length of the propodi, and a little more slender but not more d than the others; in the two posterior pairs the dactyls are about lf the length of the propodi. Abdomen of the male six-jointed from ion of the last two joints; first two joints visible from above; the first s much longer but not so wide as the second; the second, third, and joints decrease successively in width but are of nearly equal length; nth is longer than the preceding and the sixth is oblong, rounded at the tip, and much longer than any of the others; the sides of the abdomen behind the second joint are concave and at the middle of each joint there is a conical protuberance, the last joint bearing traces of two. In the female the abdomen is large and rounded and composed of five joints from the fusion of the last three; it fits closely over the thin, laminate rim which encloses the greater portion of the sternum. As the sternum and the ventral surface of the abdomen are both hollowed out, there is thus formed a quite capacious chamber for holding the ova.

Length of male 26 mm.; breadth 17 mm.; length of first ambulatory legs 60 mm.

San Diego (Lockington); Santa Catalina Island, dredged August, 1893! Off Cape St. Lucas and Gulf of California (Miss Rathbun); Magdalena Bay, Lower California! I have seen Lockington's specimens from the latter locality, and Miss Rathbun's types of *tenuipes* from Catalina.

Subfamily INACHINÆ.

Eyes slender and retractile. Basal antennal joint usually slender throughout, not narrowing distally. Preocular spine often wanting; postocular distinct. Rostrum often bifid or two-spined.

Genus **Oregonia** *Dana.*

Carapace flattened, not spinose. Spines of rostrum long, slender, and contiguous. Ambulatory legs of moderate length, the penultimate joint similar to the preceding one, not dilated and compressed. Near *Eurypodius.*

Type.—*O. gracilis* DANA.

Oregonia gracilis *Dana.*

Oregonia gracilis DANA, Am. Jour. Sci. (2), Vol. XI, 1851, p. 270; Crust. U.S. Expl. Expd., Part I, 1852, p. 106, Pl. III, fig. 2. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 456. BATE, in Lord's Naturalist in Vancouver's Island, Vol. II, 1866, p. 269. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 74. SMITH, Rept. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 209. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 21. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 59.

Oregonia hirta DANA, Am. Journ. Sci. (2), Vol. XI, 1851, p. 270; Crust. U. S. Expl. Expd., Part I, 1852, p. 107, Pl. III., fig. 3. STIMPSON, l. c., p. 456. LOCKINGTON, l. c., p. 75. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471.

Oregonia longimana BATE, Proc. Zool. Soc. London, 1864, p. 663; Ann. Nat. Hist. (3), Vol. XV, 1865, p. 487; in Lord's Nat. in Vancouver's Is., Vol. II, 1866.

Carapace subtriangular, more or less setose and roughened by minute prominences. Median, cardiac, and branchial regions tumid. The rostral horns may exceed the breadth of the interorbital space. Postorbital spines slender, acute, inclined forwards, and situated some distance behind the orbit. A prominence on the anterior side of the eye peduncle. The septum separating the antennulary fossettes is produced into a spine. Maxillipeds setose, the ischium produced forward into a rounded process at the antero-internal angle. Chelipeds rather slender, the merus subcylindrical and roughened with minute tubercles; carpus rounded; hand long, slender, somewhat compressed, the margins obtuse; fingers slender, smooth, incurved. Legs subcylindrical and decreasing in length posteriorly; dactyls slightly exceeding one-half the length of the propodi and terminated by long, corneous claws.

Behring Sea to Oregon (Rathbun); Vancouver Island (Bate, Smith); Puget Sound (Dana); northern California!

Like many other maioid crabs, this species varies greatly as regards the development of the chelipeds in the male. Speaking of a collection of specimens of this species from Vancouver's Island, Professor Smith says: "The series of specimens is sufficient to show that the two forms described by Dana are sexual and belong to one species, the *gracilis* being based on the adult male, and the *hirta* on the two forms of the female. In the characters of the rostral spines and the rest of the carapax, all the larger males before me agree with the description and figures of *gracilis*, while in the same characters the females agree with *hirta*, and the smaller males are more or less intermediate between the two forms. But among the females themselves there are two forms: all the adult and fertile specimens having the abdomen very broad, and nearly orbicular, while in the other specimens (most of them small, but some of them as large as the smaller of those with orbicular abdomens) the abdomen is much narrower and elliptical, as shown in Dana's fig. 3, *b*. The smaller of these latter females are, perhaps, merely immature individuals, but the larger are truly dimorphic, sterile females, such as are found in many genera of Brachyura, and here, as in most similar cases, the larger of the sterile individuals show considerable approach to the males in the form of the carapax, etc.

"In the largest male before me the merus of the chelipeds reaches nearly or quite to the tip of the rostrum, and, in this respect, agrees with Bate's *O. longimana*, though the chelipeds are not nearly twice as long as the carapace, if the rostrum is, as it is usually, included in the length."

Genus **Erileptus** *Rath.*

Carapax broadly triangular; regions well defined, convex. There is a postorbital and also a supraorbital spine. Rostrum slender and simple. Abdomen and sternum granulate; abdomen six-segmented. Basal

antennal joint with a slender spine at the antero-external angle. Merus of external maxillipeds with a prominent, obtuse lobe on the inner margin. Chelipeds very long, slender, subcylindrical; fingers short, arched. Ambulatory legs very slender, shorter than the chelipeds; dactyls almost straight.

Type.—*E. spinosus* RATH.

Erileptus spinosus *Rath.*

Erileptus spinosus RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 227.

Carapace spiny; gastric region with two spines arranged transversely and a median spine behind; branchial region having a long spine with a smaller spine in front of it and two spines on the margin; hepatic region with a marginal spine; a spine on the cardiac area and a small spine on the orbital arch. Rostrum slender, with spinulous margins. A small postorbital spine some distance behind the eye. Chelipeds long, granulated, merus with a spine above; hand slender, distally widened. A spine on the first abdominal segment.

Length 10 mm.; width 6 mm.; length of cheliped 28 mm.

Off San Diego, California, 36 fathoms (Miss Rathbun). I have not seen this species.

Subfamily ACANTHONYCHINÆ.

Eyes small, immobile, or only partially retractile; basal antennal joint enlarged at base and narrowing distally. Rostrum bifid, or two-spined.

Genus **Epialtus** *Milne-Edw.*

Rostrum flattened, bifid or two-spined. Preocular spine present or absent. Eyes more or less mobile. Legs of moderate length, the penultimate joint not dilated and compressed. Flagellum of the antennæ concealed beneath the rostrum. The carapace is smooth or slightly tuberculated and the margins are not incised.

Type.—*E. bituberculatus* MILNE-EDW.

Epialtus productus *Randall.*

Epialtus productus RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 110. GIBBES, Proc. Am. Ass. Adv. Sci., 1850, p. 173. DANA, Crust. U. S. Expl. Expd., Part I, 1852, p. 133, Pl. VI, fig. 2. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 457. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 77. RATHBUN R., The Fisheries of the U. S., Sec. I, 1884, p. 778, Pl. CCLXVIII. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 22. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 42. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 68.

Carapace smooth and not distinctly areolated. Rostrum deeply notched, the inner margins of the horns slightly concave, the outer convex. There is a small, triangular preorbital tooth; postorbital tooth small. The margin between the postorbital and the large tooth at the antero-lateral angle is concave and transverse. About midway between the antero-lateral tooth and the posterior margin of the carapace there is a large tooth pointing forwards and outwards; the sides of the carapace in front of the posterior teeth are nearly parallel; the posterior margin has a strong convexity in the middle. Chelipeds stouter, and except in old males, shorter than the first ambulatory legs; carpus carinate on the outer side; hand long and narrow, palm oblong, subcarinate above, becoming inflated with age; fingers slender, bent downward and curved inward, the inner margins dentate and contiguous throughout their length, except in old males in which they may become more or less gaping at the base. Ambulatory legs successively decreasing in length posteriorly, penultimate joints subcarinate, dactyls slender, spinulous below, and terminating in sharp, slender claws. Abdomen of the female subelliptical, the last joint triangular.

Color reddish to olive brown mottled with small, round spots of a darker hue.

Length of ordinary specimen from tip of rostral horns 78 mm.; width between antero-lateral horns 58 mm.

Alaska to Lower California.

This species is abundant on our coast; it is commonly known as the "kelp crab" from the fact that it is usually found on kelp the color of which it closely resembles. There may be small, setose tubercles on the median region of young specimens, but they disappear with age, and there are two rows of curved setæ on the upper side of the rostrum which persist for a longer time. Old specimens are almost entirely devoid of hairs or setæ of any kind.

Epialtus Nuttallii *Rand.*

Epialtus Nuttallii RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 109, Pl. III. GIBBES, Proc. Am. Ass. Adv. Sci., 1850, p. 173. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 458. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 77. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXII, 1898, p. 572.

Epialtus (Antilibinia) Nuttallii RATHBUN M., l. c., Vol. XVII, 1894, p. 69.

Carapace ovate, convex, smooth, and not areolated. Rostrum prominent, depressed, flattened above, and having a small triangular notch at the tip. No preorbital tooth; postorbital small. The two teeth on the sides of the carapace are much smaller than in *E. productus*, and the margins between them are convergent anteriorly. The chelipeds are very similar to those of *productus*. Ambulatory legs subcylindrical; dactyls stouter than in the preceding species.

Southern California—Santa Barbara! Santa Catalina Island! San Diego! Ballenas Bay, Lower California (Rathbun).

Genus **Mimulus** *St.*

Carapace flattened, more or less pentagonal; antero-lateral margin laminate and cut by a narrow fissure into two closely approximate lobes. Rostrum short, bifid, and horizontal. Orbits incomplete below, but furnished above with a preorbital and postorbital spine. Eyes not concealed when retracted. Merus of the external maxillipeds short, the external angle obtuse, the internal angle incised; outer margin of the exognath dilated. Hand of the chelipeds much compressed and subcarinate. The propodi of the ambulatory legs have a setose tooth near the middle of the inferior margin. First pair of ambulatory legs exceeding the others.

Type.—M. foliatus ST.

Mimulus foliatus *St.*

Mimulus foliatus STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 200, Pl. III, fig. 1. A. MILNE-EDWARDS, Crust. Miss. Sci. au Mex., Pt. V, p. 145, Pl. XVIII, fig. 4.

Pugettia (Mimulus) foliata NEWCOMBE, Bull. Nat. Hist., Soc. Brit. Col., 1893, p. 22.

Pugettia foliata RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 72.

Carapace flattened and marked with several undulations; median region tumid and bearing two small, obsolescent tubercles in front of which there may be two rows of curved setæ. Rostral horns flattened, with convex outer margins, the notch between them narrowly triangular and setose. On the upper side of the rostrum there are two double rows of curved setæ. Preorbital tooth large, triangular, acute; postorbital small and pointing obliquely downwards, and separated by a fissure from the preorbital tooth. The lateral expansions of the carapace are a little reflexed, and the margin behind the incision is nearly twice the length of that in front. The antero-lateral and postero-lateral angles are wide and the latter are somewhat produced. An obsolescent tubercle on the posterior part of the branchial region. Pterygostomian regions with several blunt teeth. Peduncle of antennæ about reaching tip of rostrum. Chelipeds of the male large, the merus rough and cristate on the inner margin; carpus with a lamina on the inner margin; hand oblong, the fingers bent downward and curved inward, somewhat gaping near the base but distally dentate. In the females and young males the chelipeds are relatively smaller, the crista on the merus not so prominent, and the fingers contiguous and dentate along the entire inner margin. First pair of ambulatory legs longer and a little more compressed than the others, the penultimate joint subcarinate above. Abdomen of female elliptical, seven jointed. Abdomen of the male widest at the third segment, narrowing rapidly to the fifth which is about equal to the sixth; last segment narrow and longer than the preceding one.

Color a dull purplish, the legs crossed by light bands.

Length of carapace 30 mm.; greatest width 32 mm.

Found among rocks at low tide. Alaska; British Columbia (Rath.); northern to southern California! Mexico (Milne-Edwards).

Genus **Pugettia** *Dana.*

Rostrum two-spined. The margin of the carapace behind the eyes is produced into an alate expansion behind which it is somewhat constricted. The upper surface of the carapace is furnished with spines or tubercles. The flagella of the antennæ are not entirely covered by the rostrum. The ambulatory legs are slender and do not have the penultimate joint dilated and compressed. The preocular spine is large and the eyes are mobile.

Type.—P. gracilis DANA.

Pugettia Richii *Dana.*

Pugettia Richii DANA, Am. Jour. Sci. (2), Vol. XI, 1851, p. 268; Crust. U. S. Expl. Expd., Part I, 1852, p. 118, Pl. IV, Fig. 4. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 457. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 76. MIERS, Challenger Reports, Vol. XVII, 1886, p. 40. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 21. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 71.

Carapace ovate, tuberculated; median region tumid and furnished with four tubercles, the three anterior of which are nearly abreast (the anterior one a little in advance of the others); two double rows of curved setæ in front of the lateral tubercles, and two similar rows on the rostrum. Cardiac and intestinal regions each furnished with a tubercle; two tubercles on the branchial region, the one situated before the other. Rostrum prominent, the horns divaricate and convex above, the triangular notch between them hairy. Supraorbital tooth acute and directed forward, outward and upward. Postorbital tooth acute and triangular. Behind the postorbital there is a large, rather slender tooth which projects laterally, the tip curving forwards. At the postero-lateral angle of the carapax there is a prominent, pointed tubercle, in front of which the margin is furnished with curved setæ. A spine on the sub-branchial region below the middle of the space between the postero-lateral tubercle and the large, curved tooth. Pterygostomian region with three to six small teeth. Surface of the ischium of the maxillipeds plane, but sometimes bearing a trace of a longitudinal groove; exognath not grooved. Chelipeds large in the adult males, much shorter and more slender in the females; the merus bears a few tubercles on the upper side but no carina; the inner side may become strongly ridged in adult males, but it is generally rounded in young males and females; the carpus has two or three cristæ which become more prominent in old males; hands compressed, the upper edge acute; fingers shorter than the palm, and gaping at the base in old males. Legs subcylindrical and crossed by light-colored bands; merus and propodus not crested. Color reddish.

Length $1\frac{7}{16}$ in., width across gastric region between tips of horns $\frac{13}{16}$ in.; across cardiac region $1\frac{1}{16}$ in.

British Columbia; Puget Sound; entire coast of California! San Diego! Found at low tide.

Pugettia gracilis *Dana.*

Pugettia gracilis DANA, Am. Journ. Sci. (2), Vol. XI, 1851, p. 268; Crust. U. S. Expl. Expd., Part I, 1852, p. 117, Pl. IV, fig. 3. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 456. MIERS, Challenger Reports, Vol. XVII, 1886, p. 40. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 22. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 69.

Pugettia Lordii BATE, Proc. Zool. Soc. London, 1864; Ann. Nat. Hist. (3), Vol. XV, 1865, p. 486; in Lord's Nat. in Vau. Is., Vol. II, 1866, p. 265.

Pugettia quadridens var. *gracilis* ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 43.

Closely allied to *P. Richii*. Carapace lyrate to broadly ovate, convex, tuberculated, the tips of the tubercles often furnished, as in the preceding species, with tufts of setæ. The number and position of the tubercles are the same as in *Richii* except that there may be a few small tubercles, or tufts of setæ on the branchial regions. The cardiac tubercle may become scarcely visible in old specimens. Median region tumid, the middle anterior tubercle small, and sometimes obsolete. Curved setæ as in *Richii*. Rostrum less prominent than in the preceding species; supraorbital tooth broader than in *Richii*, separated by an incision from the postorbital tooth which is triangular, acute and points more nearly forwards than it does in the preceding species. Behind the postorbital is a broadly triangular tooth, the posterior margin of which is *nearly longitudinal*. Postero-lateral tubercle smaller than in *Richii*. Ischium of the maxillipeds with a longitudinal groove; exognath also grooved. Spine on sub-branchial regions small or wanting. Merus of the chelipeds with a prominent irregularly dentate carina on the upper side; carpus cristate. Legs subcylindrical, the merus and propodus more or less carinated above, especially in the anterior pairs.

Length 28 mm.; width between antero-lateral horns 16.25 mm.; between postero-lateral horns 20.5 mm.

Alaska! Vancouver Island, Puget Sound, Oregon, northern California! Farallon Islands! southern California. Found at low tide.

This species may easily be distinguished from *Richii* by the lyrate form of the carapace, the form of the large tooth behind the postorbital, by the crest on the merus of the chelipeds and the subcarinate joints of the ambulatory legs.

Pugettia Dalli *Rath.*

Pugettia Dalli RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 232.

A small species closely allied to *P. Richii*, the young of which it closely resembles. Carapace subtriangular, tuberculated; the tubercles on the gastric region are disposed as in the preceding species, but the anterior and posterior tubercles are small or obsolescent; there is a tubercle on the intestinal region and a prominent one on the cardiac; a small tubercle on the branchial region in the position of the posterior one in the other species. Rostrum much resembling that of *Richii*, but with slightly more slender horns. Supraorbital tooth acute; postorbital flattened and pointing obliquely downwards; the tooth behind the postorbital is more slender and spine-like than in *Richii*, and does not curve so strongly forwards, Postero-lateral tubercle acute, prominent, spine-like. No sub-branchial spine. Ischium of the maxillipeds grooved. Chelipeds of the male large, the merus with an irregular carina on the upper and inner margins; carpus strongly carinated on the inner and upper margins and irregularly ridged on the outer side; hand large, wider than in *Richii*, the upper edge acute; fingers strongly gaping at base, meeting only at the tips, a tooth on the movable one near the base. Chelipeds in the female smaller than in the male, hand narrower, the fingers not gaping at the base. Legs longer and more slender than in specimens of *Richii* of equal size; the joints not carinated.

The females have a broader carapace than the males and the gastric region is more tumid, and the branchial regions more distinctly areolated.

Length of carapace in male 11 mm.; width without spines 6.5 mm.; length of cheliped 13 mm.; width of hand 3.3 mm.

Santa Catalina Island, San Diego (Miss Rathbun); San Pedro! off San Diego!

Described from specimens received from Miss Rathbun.

Subfamily DASYGYINÆ

Eyes short, completely retractile. Postocular spine large. Basal antennal joint considerably enlarged throughout its length. Rostrum simple or bifurcated. Preocular spine present or absent. Legs generally slender.

Genus **Dasygyius** *Rathbun.*

(*Microrhynchus* BELL and *Neorhynchus* MILNE-EDWARDS preoc.)

Rostrum short and simple. No preocular spine. Merus of maxillipeds cordiform. Anterior legs in the male small. Ambulatory legs of moderate length.

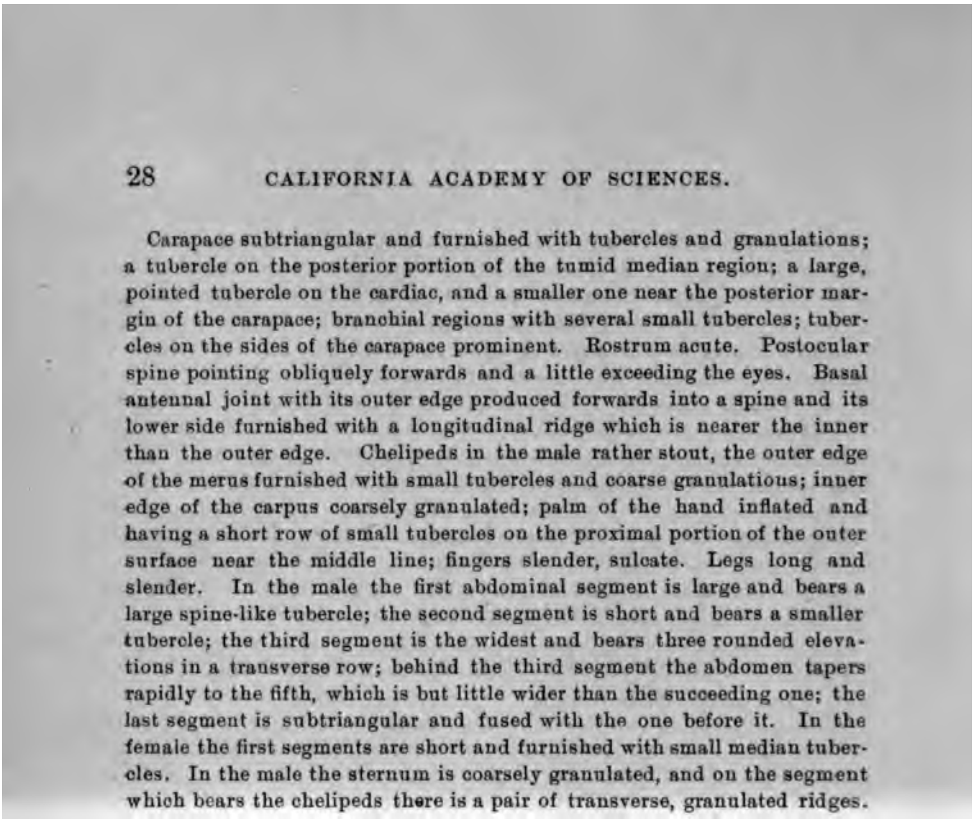
Dasygyius tuberculatus *(Lock.)*

Inachus tuberculatus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 30.

Microrhynchus (*Inachus*) *tuberculatus* LOCKINGTON, l. c., 1877, p. 64.

Neorhynchus mexicanus RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 233.

Dasygyius tuberculatus RATHBUN M., l. c., Vol. XXI, 1898, p. 570.



Carapace subtriangular and furnished with tubercles and granulations; a tubercle on the posterior portion of the tumid median region; a large, pointed tubercle on the cardiac, and a smaller one near the posterior margin of the carapace; branchial regions with several small tubercles; tubercles on the sides of the carapace prominent. Rostrum acute. Postocular spine pointing obliquely forwards and a little exceeding the eyes. Basal antennal joint with its outer edge produced forwards into a spine and its lower side furnished with a longitudinal ridge which is nearer the inner than the outer edge. Chelipeds in the male rather stout, the outer edge of the merus furnished with small tubercles and coarse granulations; inner edge of the carpus coarsely granulated; palm of the hand inflated and having a short row of small tubercles on the proximal portion of the outer surface near the middle line; fingers slender, sulcate. Legs long and slender. In the male the first abdominal segment is large and bears a large spine-like tubercle; the second segment is short and bears a smaller tubercle; the third segment is the widest and bears three rounded elevations in a transverse row; behind the third segment the abdomen tapers rapidly to the fifth, which is but little wider than the succeeding one; the last segment is subtriangular and fused with the one before it. In the female the first segments are short and furnished with small median tubercles. In the male the sternum is coarsely granulated, and on the segment which bears the chelipeds there is a pair of transverse, granulated ridges.

The measurements of Lockington's specimens which I have had the opportunity of examining are as follows:

	Length.	Breadth.	Length of first ambulatory leg.
Male	.75 in	.55 in	1.55 in.
Female	.56 in	.38 in	.94 in.

The rostrum varies much in length; in old males it is often produced into a sort of spine; in females and young males it is often quite broadly triangular.

San Diego! Magdalena Bay (Lockington)! Gulf of California (Rathbun)! Panama Bay (Rathbun).

I have seen the types of both *tuberculatus* and *mexicanus*.

Genus **Loxorhynchus** *St.*

Rostrum two-spined, the spines coalescent at the base and then divergent. Preocular and postocular spines prominent. Orbits interrupted by a deep sinus above and below. Basal antennal joint enlarged, subquadrate, and having a laterally projecting spine at the outer angle. A spine beneath the postorbital near the base of the first joint of the antenna. Epistome large and subtrapezoidal. Ischium of the maxillipeds produced forwards at the antero-internal angle; merus entire at the distal end. Ambulatory legs subcylindrical, of moderate length, and decreasing in length posteriorly. The carapace is spiny and the abdomen seven-jointed.

Type.—L. grandis ST.

Loxorhynchus grandis *St.*

Loxorhynchus grandis STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 85; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 452, Pl. XIX, fig. 1, Pl. XXII, fig. 1; Ann. N. Y., Nat. Hist., Vol. VII, 1859, p. 49. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 74.

Carapace very broadly ovate, inflated and covered with small, conical tubercles of nearly equal size. Rostrum a little longer than broad, much deflexed, the horns convex above and below and separated for a little more than half their length. Preorbital spine large, often more or less double pointed; postorbital spine subconical, acute. Chelipeds in the male large, tuberculated; hand oblong, palm inflated, the edges rounded. Ambulatory legs subcylindrical, sparingly tuberculated, the antepenultimate joints grooved above; a small tubercle near the end of the merus. Abdomen of the male contracted behind the third segment, the three following segments of nearly equal width (the fourth slightly wider at the base); fifth and sixth segments nearly equal and longer than the third or fourth; last joint subtriangular, but rounded at the tip. Abdomen of female broadly elliptical, all the joints free; the joints increase in length from the third to the sixth; last joint broadly rounded, much broader than long. Thoracic sternum transversely grooved. Carapace covered with short hairs.

Stimpson gives the following measurements of a female:—

Length of carapace	5.55 in.
Width of carapace	4.54 "
Length of first pair of legs	4.90 "
Length of second pair of legs	6.45 "
Length of last pair of legs	4.75 "

Farallon Islands! near San Francisco! Santa Catalina Island! San Pedro! San Diego!

Loxorhynchus crispatus *St.*

Loxorhynchus crispatus STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 453, Pl. XXII, figs. 2, 3 and 4. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 45. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 74.

apace rather narrowly triangular, somewhat flattened, not nearly so and inflated as in the preceding species. Some of the tubercles are h larger than others, the principal ones being located as follows: a le on the cardiac region which is connected with a tubercle on the stinal by a prominent e; two t les on the branchial regions, e anterior of which is somewhat near middle line; a large tubercle hepatic region; a tubercle on the a rior and one on the posterior of the median region; a tubercle either side of the anterior an tubercle; a row of small blunt tubercles on the median region ding to each rostral horn. Rostrum longer than broad, not so much ssed as in *grandis*, and having m ivergent horns which are sepa- for more than half the length rostrum. Preorbital spine inent, subconical. Chelipeds rather ender; merus with three or small tubercles on the upper side; arpus with small tubercles; d slender, slightly wider at the base, margins rounded. Ambulatory legs rather short, the first pair in the female usually longer than the chelipeds, merus grooved above; dactyls shorter and stouter than in *grandis*, about one-half the length of the propodi. Abdomen of the male similar to that of the preceding species, but the last joint is narrower. The chelipeds in the male are much longer than in the females, and in old specimens they become enormously lengthened.

Farallon Islands! San Francisco Bay! Monterey, Santa Barbara! San Pedro! San Diego! San Miguel Island (St.).

The carapace in this species is covered by a very dense, even coating of peculiar, short, thick hairs—if hairs they may be called—which are so closely crowded together that no spaces are left between them. In some places they are less than twice as long as thick. Along the sides of the carapace and on the median region there are the usual curved setæ, but on the legs and abdomen there are numerous large, clavate setæ; between these and the short thick setæ there are, however, all stages of transition.

These crabs are generally found so thickly covered with foreign growths, such as hydroids, seaweeds, bryozoans and sponges, that, in their natural environment, they are scarcely recognizable as crabs at all.

Family MAIIDÆ.

"Eyes retractile within tolerably well-defined orbits which are often more or less incomplete below, or marked with open fissures in their upper and lower margins. Basal antennal joint always more or less enlarged."

Subfamily MAIINÆ.

"Carapace usually subtriangular. Rostrum well-developed. Anterior legs in the male usually enlarged; fingers not excavate at the tips."

KEY TO THE GENERA.

Rostrum vertically compressed and notched. Orbits shallow.
  Ambulatory legs compressed and flattened ....*Chionœcetes.*
  Ambulatory legs subcylindrical.
    Second joint of antenna dilated. Carapace lyrate.........*Hyas.*
    Second joint of antenna slender, subcylindrical. Carapace pyriform...*Herbstia.*
Rostrum composed of two more or less divergent spines. Orbits deep.
  First ambulatory legs very long. Rostral horns slender.
    Carapace spiny.......................................*Hyastenus.*
  First ambulatory legs moderate.
    No preocular spine....................................*Pelia.*
    A preocular spine. Rostrum flattened ....*Scyra.*

Genus **Hyas** *Leach.*

Rostrum bifid, flattened, the horns by a narrow fissure. Orbits shallow and open above, with a fissure above and below. Eyes partially visible from above when retracted. No preocular spine. Basal antennal joint much enlarged, the second moderately dilated, the third narrow. Carapace flattened, more or less tuberculated, but not spiny. Ambulatory legs subcylindrical and of moderate length.

Type.—Hyas araneus.

Hyas lyratus *Dana.*

Hyas lyratus DANA, Am. Journ. Sci. (2), Vol. XI, 1851, p. 268; Crust. U.S. Expl. Expd., Part I, 1852, p. 86, Pl. I, fig. 1. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 450. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 64. MIERS, Challenger Reports, Vol. XVII, 1886, p. 47. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 72, Pl. III. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 20.

Carapace lyrate and furnished with blunt tubercles. Median region tumid, and generally furnished with two elevations, one near the middle and one behind; post-median region prominent, pustulate or roughened; cardiac region furnished with a subconical elevation; branchial regions elevated at the middle and crossed by a more or less evident line of rounded tubercles. Rostrum shorter than the width of the interorbital space, the cleft between the horns narrow. A tooth on the anterior margin of the optic peduncle. Basal antennal joint with a few small teeth on each margin and a prominent, smooth tubercle at the antero-external angle; second joint dilated and almost entirely visible from above. A small tooth on the first joint below the articulation of the second. Maxillipeds granulated. Behind the eyes is an alate expansion, the anterior and posterior margins of which are generally nearly parallel, outer margin long and a little concave; anterior angle acute; a small tooth near the base of the convex posterior margin of this expansion, behind which the side of the carapace is quite deeply indented. Behind the alate expansion the margin of the carapace is furnished with a row of small tubercles. Merus of the chelipeds with a few small tubercles, which are more prominent at the angles; hands narrow, compressed, smooth or granulated, the upper margin compressed and roughened by small tubercles; fingers nearly smooth. The abdomen of the male is widest at the second and third segments, behind which the sides run nearly parallel to the last joint, which is distally truncated and over twice as broad as long. Abdomen of the female broadly elliptical, the joints increasing in length from the second to the last.

Locality of specimens described:—

56° 40′ N.	169° 20′ W.	43 fms.	2 spms.
56° 58′ N.	170° 09′ W.	25 "	1 "
56° 34′ N.	170° 17′ W.	62 "	2 "

This species ranges from the extreme end of the Aleutian Islands to Puget Sound, whence it was first reported by Dana.

Genus **Hyastenus** *White.*

Carapace subpyriform, convex, smooth, tuberculated, or spiny. Spines of rostrum long, slender, and diverging from the base. Preocular spine small or obsolete. Eyes small, the peduncles slender and completely retractile within the small orbits which have a lateral aspect, and a fissure, or hiatus in the upper and lower margins. Basal antennal joint large; flagellum usually exposed and visible from above at the sides of the rostrum. Ambulatory legs elongated, subcylindrical and unarmed, the first pair usually much the longest. Abdomen of the male seven-jointed.

This genus is divided by Miers into two subgenera, which, however, "are connected together by numerous gradations." The one, *Hyastenus*, is characterized by having few or no spines on the carapace and by the absence of a spine at the external angle of the basal antennal joint. The other, *Chorilia*, has the carapace spiny and the basal antennal joint is furnished with a spine. *Hyastenus (Chorilia) longipes* is the type of the latter subgenus.

Hyastenus (Chorilia) longipes *(Dana).*

Chorilia longipes Dana, Am. Journ. Sci. (2), Vol. XI, 1851, p. 269; Crust. U. S. Expl. Expd., Part I, 1852, p. 91, Pl. I, fig. 5. Stimpson, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 455. Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 69. Whiteaves, Can. Nat. (2), Vol. VIII, 1878, p. 470. Rathbun M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 572.

Hyastenus (Chorilia) longipes Miers, Journ. Linn. Soc. London, Vol. XIV, p. 658; Proc. Zool. Soc. London, 1879, p. 27.

Hyastenus japonicus Miers, Proc. Zool. Soc. London, 1879, p. 27, Pl. I, fig. 2; Challenger Reports, Vol. XVII, 1886, p. 56, (fide Rathbun M.).

Hyastenus longipes Miers, Challenger Reports, Vol. XVII, p. 56. Rathbun M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 85, Pl. VII. Newcombe, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 20.

Carapace pyriform, inflated, and covered with sharp spines of unequal size. Median region tumid, with two median spines and a row of three spines on either side, the posterior one being the largest and situated a little behind the middle of the interval between the two spines on the middle line; a prominent spine on the tumid hepatic region; several small spines on the cardiac region and a small spine or tubercle near the posterior end of the intestinal. The spines on the branchial regions are numerous and variable, but there is usually a more prominent spine near the middle. Pterygostomian regions with a row of teeth or spines. Rostrum long, the horns nearly straight, pubescent and divergent. Preorbital spine prominent, acute, postorbital acute and pointing obliquely downwards. Basal antennal joint armed at its external angle with a slender spine, the margin behind which is armed with two smaller spines. There may be a few minute spinules at the apex of the eye-stalk. Merus of the chelipeds furnished with small tubercles, which are more prominent on the angles; carpus furnished with small tubercles on the outer side, which are more or less plainly arranged in three or four rows; hands long, slender, compressed, palm subcarinated above, nearly smooth, and generally having a small tubercle on the outer side near the articulation; fingers long and slender. Dactyls of the slender ambulatory legs long and nearly straight. Abdomen of the male tapering from the third segment, the last joint longer than broad and rounded at the tip. Abdomen of the female broadly elliptical, the joints increasing in length from the third to the last. In some females, either immature or sterile, the abdomen is narrowly elliptical and not nearly so wide as the thoracic sternum. The legs and many parts of the body are covered with a short pubescence.

Miss Rathbun, who has carefully studied a large number of specimens of this species, gives the following account of its variations: "This species ranges from 57° north latitude, off Kadiac, Alaska, to 32° north latitude, off San Diego, Calif., and in depth from 27 to 603 fathoms. It exhibits wide variations from Dana's types, especially in more southern latitudes, where, as a rule, the carapace is very much swollen at the branchial regions, making the width much greater in proportion to the length; the second and third joints of the antennæ are much more slender; the hepatic region is furnished with a sharp spine; and, lastly, the tubercles of the carapace are much more numerous and some of them spinous. These characteristics, if uniform, would be specific, but the two extremes intergrade to such an extent as to render impossible even a varietal separation. The broad form is, with one exception, confined to deep water; the typical *longipes* ranges from 27 fathoms in the north to 456 in the south. Variations exist in specimens from the same locality; for example: The broad forms may possess a hepatic spine or a tubercle; the antennal joints are narrow in some individuals and wide in others. Occasional specimens of the narrow form have a sharp hepatic spine. * * * The width of the typical form ranges from 0.71 to 0.8 of its length; of the wider form from 0.82 to 0.9 of its length; the length being measured from between the bases of the cornua."

Genus **Pelia** *Bell.*

Carapace subpyriform. Rostrum composed of two divergent spines which are united at the base. Orbits small, with a lateral aspect and with a superior and an inferior marginal hiatus; the upper orbital margin smooth and devoid of a preorbital spine. Eyes small, with slender peduncles. Basal antennal joint elongated, its distal portion visible from above at the sides of the rostrum; flagellum well developed. Merus of the maxillipeds with a notch at the articulation of the palp, legs of moderate length; first ambulatory legs much longer than the others; merus compressed, acute above, dactyls not denticulated below.

Type.—P. pulchella BELL.

Near *Pisoides*, but having a narrower basal antennal joint, the distal end of which is visible from above. Differs from *Pisa* in the absence of spines on the under side of the dactyls.

Pelia tumida (*Lock.*)

Pisoides (?) *tumidus* LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, pp. 30 and 67.

Microphrys tumidus MIERS, Challenger Reports, Vol. XVII, 1886, p. 83.

Carapace pyriform, rounded, tumid, covered with pubescence, but entirely devoid of spines. Median region rounded, smooth, much elevated, and furnished with a small rounded tubercle at the summit; branchial regions inflated; cardiac region with a small rounded elevation. Rostrum depressed, nearly one-half the length of the carapace and bifurcated for

about half its length, the horns narrow, divergent, and slightly upturned at the tip. No preorbital tooth; postorbital small. Antero-lateral margin entire. Basal antennal joint considerably longer than wide and devoid of teeth with the exception of the one at the antero-external angle, which is plainly visible from above; tip of the peduncle reaching but beyond the apex of the notch between the rostral horns, not nearly reaching the tip of the rostrum as in *pacifica;* flagellum rather long. Merus of the maxillipeds distally truncated. Chelipeds unarmed; merus not nearly reaching the tip of the rostrum; hand oblong, inflated, the edges obtuse and parallel; fingers widely gaping, a tubercle on the inner margin of the dactyl near the base. Ambulatory legs compressed, pubescent, the margins furnished with a thick fringe of stiff setæ; dactyls sharply curved at their sharp, corneous tips.

Length 12 mm.; width 8 mm.; length of first ambulatory leg 12 mm.

Described from a single male specimen from Magdalena Bay, Lower California, preserved in the museum of the California Academy of Sciences. This specimen is, I believe, one that is mentioned by Lockington, l. c., p. 67.

San Diego (Lockington), Magdalena Bay, Lower California (Lockington)! Santa Catalina Island!

Pelia pacifica *Milne-Edw.*

Pelia pacifica A. MILNE-EDWARDS, Miss. Sci. au Mex., Vol. I, Pt. V, 1875, p. 73, Pl. XVI, fig. 3. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1894, p. 90; and Vol. XXI, 1898, p. 573.

Near *mutica*, but having a shorter and wider carapace with the prominences on the gastric and cardiac regions more pronounced. Rostrum short and stout. Basal antennal joint shorter and wider than in *mutica*.

Length of carapace 9 mm.; width 7 mm.

Bay of Panama (M.-Edw.); Gulf of California, Magdalena Bay, Lower California! San Diego, Santa Catalina Island (Miss Rathbun).

Genus **Herbstia** *Milne-Edw.*

Carapace broadly triangular or subpyriform, tuberculated or spinose. Rostrum short, the horns acute, vertically compressed, and dilated at the base. Orbits shallow, with or without a preorbital spine. Eyes short and not entirely concealed when retracted. Basal antennal joint moderately dilated and armed with an antero-external spine, the distal portion not entirely covered by the rostrum. Merus of maxillipeds distally truncated and not produced at the outer angle. Ambulatory legs rather slender, subcylindrical, and of moderate length; dactyls nearly straight, acute. Abdomen in the male seven-jointed.

This genus is divided into two subgenera as follows:

Herbstia: Inferior margin of orbit not dentate. Ambulatory legs not spinose.

Herbstiella St.: Inferior margin of orbit armed with a tooth or spine. Merus of ambulatory legs spinose.

The subgenus *Herbstiella* to which our species belong is almost exclusively West American.

Herbstia (Herbstiella) camptacantha *St.*

Herbstia parvifrons Stimpson, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 185 (not *H. parvifrons* Randall).

Herbstiella camptacantha Stimpson, l. c., Vol. X, 1871, p. 94.

Herbstia camptacantha A. Milne-Edwards, Miss. Sci. au Mex., Vol. I, Pt. V, p. 78, Pl. XVIII, fig. 3.

Herbstia (Herbstiella) camptacantha Miers, Journ. Linn. Soc. London, Vol. XIV, 1879, p. 655; Challenger Reports, Vol. XVII, 1886, p. 49. Rathbun M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 79.

Fisheria depressa Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 72.

Carapace ovate, punctate, much flattened, and armed above with several small tubercles. Median region tumid, separated from the branchial and cardiac regions by deep sulci and armed, in front, with four tubercles in a transverse line, the middle tubercles separated from each other by about twice the distance that they are from the lateral ones; a median, rounded tubercle on the posterior portion of the median area; three, or four small tubercles on the cardiac region and about five on each branchial region; two tubercles, in a transverse line, on the intestinal area. Rostral horns flattened and divergent, forming more than one-half the length of the rostrum. Preorbital spine acute; there is a small spine, or tooth, on the margin of the orbit above the postorbital tooth, while below it there is a spine on the inferior orbital margin. The spine at the antero-external angle of the basal antennal joint is prominent, and on the margin behind it there are two spines, the posterior of which is sometimes reduced to a small, blunt tooth. Beside the postorbital tooth the antero-lateral margin is furnished with about five spines, and there are several smaller ones on the postero-lateral margin. Pterygostomian region armed with several spines. Chelipeds in the adult male long; merus long, subcylindrical, armed above with numerous spines and usually having a few spines at the distal end of the lower margin; carpus with the outer surface tuberculated; hand large, smooth, elongated and compressed; fingers widely gaping. Ambulatory legs pubescent; merus armed above with numerous spines, and with one or more spines near the distal end of the lower margin; carpus with one or more spines above; propodi long, slender, subcylindrical, unarmed, and about twice the length of the dactyls.

Cape St. Lucas, Acapulco, Mexico (St.); Mazatlan, Magdalena Bay! Lower California; San Diego! Santa Catalina Island! San Pedro! San Clemente Island!

This species differs from *parvifrons* in having the hand entirely devoid of spines. The chelipeds in the male become greatly elongated with age; the hand becomes narrower, the spines on the lower side of the merus become obsolete, while those on the upper side become blunt. In one specimen from Port Escondido the chelipeds were two and one-half times the length of the carapace; the merus was a little longer than the carapace and the hand about one-third longer. The carapace is covered with a pubescence which disappears to a greater or less extent with age.

I have seen the two specimens of *Fisheria depressa* referred to by Lockington as "No. 21" (l. c., p. 73).

Herbstia parvifrons *Randall.*

Herbstia parvifrons RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 107. GIBBES, Proc. Am. Ass. Adv. Sci., 1850, p. 170. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 451.

I have not seen this species nor do I believe that anything has been found since Randall's specimen was taken which answers to his description, which is quoted below.

"Corpore depresso, in latere spinoso, pedibus spinosis, leviter dilatatis, manibus lævigatibus, dactylis apice serrulatis."

"Body flattened above, punctured, somewhat hairy; sides spinous, especially anteriorly; rostrum very short; feet spinous above; hand of the anterior pair with only a few very small spines at the base; pincers without teeth, except toward their apices, where for one-third of their whole length they are hollowed out on their prehensile side, so that when closed they become interlocked at their extremities by means of their serratures. Length of carapax about one inch."

One specimen from Western America.

Genus **Chionœcetes** *Kröyer*.

Carapace broad, depressed, more or less tuberculated or spinose. Rostrum short, flattened and notched, not depressed. Orbits shallow, open above so that the short, thick eye-peduncles are visible from above when retracted. No preorbital spine; postorbital present. Basal antennal joint very narrow, with a terminal spine; second and third joints not dilated; flagellum short. Ambulatory legs more or less compressed and of moderate length. Abdomen seven-jointed.

Type.—*C. opilio* (FABR.).

Chionœcetes opilio *(Fabr.)*

Cancer phalangium O. FABRICIUS, Fauna Groenlandica, 1780, p. 234.
Cancer opilio O. FABRICIUS, Danske Vid. Selsk. Skr. nye Saml., Band. III, 1788, p. 181, plate.
Chionœcetes opilio KRÖYER, Naturh. Tidskrift (1), 2, 1838, p. 249.
Chionœcetes behringianus STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1856, p. 84; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 449.

For further references see Rathbun, Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 74.

This species extends from Greenland to Behring Sea and down the west coast of America as far as British Columbia, and may, not improbably, occur within our limits. The carapace is flattened and covered with wart-like tubercles. There is no deep depression separating the branchial regions. The ambulatory legs are shorter, stouter and less spiny than in the next species.

Chionœcetes Tanneri *Rath.*

Chionœcetes Tanneri Rathbun M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 76, Pl. IV, figs. 1–4; and Vol. XXI, 1898, p. 573. Newcombe, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 19.

Carapace a little wider than long, with the postero-lateral angles broadly rounded; branchial regions tumid and produced laterally, concealing the lateral margins. The carapace is covered with spines, instead of wart-like tubercles as in *opilio*, the most conspicuous of which are arranged in more or less irregular rows. A nearly transverse row of tubercles on the branchial regions, which, near the side of the carapace, curves around and runs obliquely forwards towards the orbit. Posterior margin of the carapace spinulous; above the outer portions of this margin there begins another row of spinules, which is continued around the sides of the carapace, the spines becoming smaller anteriorly; at the bend in the row of spines on the branchial regions there begins another row of spines which runs forward to the anterior portion of the buccal area, the spines becoming smaller and more thickly set anteriorly, where they gradually spread out into a small patch of minute, irregularly placed tubercles next to the buccal area. An irregular row of spinules across the anterior portion of the median area. The upper margins of the orbit and the outer sides of the rostrum are spinulous. A small elevated patch of spinules on the cardiac region, in front of which is a deep depression, separating the branchial regions, which is rather narrow behind, but widens anteriorly, and divides into two broad depressions extending either side of the median area. Rostral horns upturned, narrower than in *opilio*, the notch between them more prominent. Basal antennal joint spinulous below. Maxillipeds more or less spinulous, and not reaching the anterior margin of the buccal area. Chelipeds spinulous, small in the female; hand narrow; fingers long. Legs spiny, becoming smoother toward the tips. A transverse spinulous or granulated ridge in front of the abdomen, in front of which the sternum is excavated. First two or three joints of the abdomen with a transverse spinulous or granulated ridge.

The largest specimen in the series studied by Miss Rathbun gave the following measurements:

Length from base of rostral horns	119 mm.
Width without spines	130 mm.
Length of first ambulatory leg	316 mm.
Length of merus of first ambulatory leg	134 mm.

Miss Rathbun's table of measurements of 18 specimens shows that in the smaller specimens the length more nearly equals the breadth than in the larger ones. In one case the length and breadth were each 32 mm., but in no case was a specimen longer than broad.

Deep water from Behring Sea to southern California; 29 to 1,625 fathoms (Miss Rathbun).

This and preceding species seen and compared.

Genus **Scyra** *Dana.*

Carapace subpyriform, tuberculated, but not spinose. Rostrum composed of two flattened horns. Orbits small, with a fissure above and below, the lower and sometimes the upper one being open. Preorbital spine present. Basal antennal joint rather narrow, with a small spine at the antero-external angle, the two following joints compressed and not concealed by the rostrum. Merus of the maxillipeds distally truncated. Chelipeds in the male well developed, the hand compressed and carinated above; fingers acute. Legs moderately long, subcylindrical, the first pair not greatly exceeding the others in length; dactyls short and acute. Abdomen seven-jointed.

Type.—*S. acutifrons* DANA.

Scyra acutifrons *Dana.*

Scyra acutifrons DANA, Am. Journ. Sci. (2), Vol. XI, 1851, p. 269; Crust. U. S. Expl. Expd., Part I, 1852, p. 95, Pl. II, fig. 2. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 455. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 69. MIERS, Journ. Linn. Soc. London, Vol. XIV, 1879, p. 663; Challenger Reports, Vol. XVII, 1886, p. 62. SMITH, Rep. Prog. Geol. Surv. Canada, 1878–9, *B*, p. 210. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 88. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 21.

Scyra (sp. undet.) WHITEAVES, Can. Nat. (2), Vol. VIII, p. 471; (see Smith l. c.).

Carapace pyriform and furnished with rounded tubercles. Median region tumid and separated from the cardiac and branchial regions by a conspicuous depression; an acute tubercle near the center of the median region, behind which is a larger and more obtuse tubercle. Branchial regions tumid and bearing a large, projecting tubercle, in front of which is an elevated prominence which may bear several small tubercles, though it is often smooth. A large tubercle on the cardiac and a smaller one on the intestinal region. Rostrum short, the horns ovate-lanceolate. Two spines or teeth on the outer margin of the basal antennal joint behind the one at the anterior angle. Preorbital spine acute. Pterygostomian regions with several rounded teeth. Chelipeds of the male large, the merus subcylindrical (somewhat flattened below), and strongly pustulate, especially at the angles; the carpus is pustulate and may have several ridges on the outer side; hand long, narrow, compressed, the palm below the wide carina often inflated; fingers deflexed and, in old males, gaping at the base, in which case there is generally a large tooth near the base of the dactyl. Legs subcylindrical, more or less pubescent, the propodi sulcate on either side; dactyls considerably shorter than the propodi and furnished with sharp, corneous tips. The third, fourth, fifth and sixth abdominal segments in the male are of nearly equal length; the seventh is longer than broad and rounded at the tip; the abdomen tapers most at the third and fourth segments, the fifth and sixth being of subequal width.

Length of carapace: *male*	35 mm.
Width of carapace	26 mm.
Length of cheliped	55 mm.
Length of first ambulatory leg	40 mm.
Length of carapace: *female*	25 mm.
Width of carapace	16 mm.
Length of cheliped	28 mm.

Alaska, British Columbia, Oregon, Farallon Islands! southern California! Santa Catalina Island! San Diego!

The individuals of this species vary considerably with age. In the old males the tubercles on the carapace are rougher and more prominent, the posterior tubercle on the branchial region projecting over the sides of the carapace; the horns of the rostrum become much widened at the base; and the chelipeds are much larger. In the females the tubercles on the carapace are smoother, those on the median region being small or obsolescent.

Family PERICERIDÆ.

Eyes retractile within the small, circular, and well defined orbits which are never incomplete as in the Maiidæ. Basal antennal joint well developed, and constituting the greater part of the inferior wall of the orbit.

Subfamily PERICERINÆ.

Carapace more or less triangular. Rostrum well developed. Second joint of the antenna not dilated. Chelipeds with the fingers acute at the tips.

Genus **Libinia** *Leach.*

Carapace orbiculate-triangular, convex, spinose. Preocular spine distinct. Rostrum of moderate length and emarginate only at the apex. Eye-peduncles short. Basal antennal joint moderately enlarged, the flagellum visible from above. Legs of moderate length. Abdomen of male and female seven-jointed.

Type.—*L. emarginata* LEACH.

Libinia emarginata *Leach.*

Libinia emarginata LEACH, Zool. Misc. (2), 1815, p. 129. RATHBUN R., The Fisheries of the U. S., Sec. I, 1884, p. 778, Pl. CCLXIX, fig. 4. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 235, Pl. XXXI, fig. 2. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894.

Libinia canalaculata SAY, Journ. Acad. Nat. Sci. Phila., Vol. I, 1817, p. 76. MILNE-EDWARDS, Hist. Nat. Crust., Vol. I, 1834, p. 300. STREETS, Proc. Acad. Nat. Sci. Phila., Vol. XXII, 1870, p. 105.

Libinia affinis RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 106. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 455. STREETS, l. c.

For further references, see Rathbun M., *l. c.*

Carapace suborbicular, much inflated, and covered with numerous small, pointed tubercles. Median region with four or five median tubercles, besides many others. Hepatic regions not distended, and furnished with three quite prominent spines, the upper one forming the first of a series of five spines (or tubercles) which extends backward upon the branchial regions. A row of five tubercles behind the median region, making nine or ten median tubercles in all. Rostrum short, triangular, the apex furnished with a very small emargination.

Length of male specimen 95 mm.; breadth 90 mm.; length of cheliped 160 mm.; of hand 84 mm.; of first ambulatory leg 158 mm.; of last leg 98 mm.

Atlantic Coast from Maine to Florida; "Western America" (Randall).

The foregoing description is based on specimens from Wood's Holl, Massachusetts. I have seen no specimens of this species from the Pacific Coast, and know of none having been found there since Randall's specimen was taken. Mr. Streets, whose words imply that he has seen Randall's type, says that this species "is undoubtedly nothing more than the young of *canaliculata*. That it is so will be evident to anyone who will take the trouble to compare them closely. It agrees with *L. canaliculata* in every respect excepting size."

Legion PARTHENOPINEA.

" Basal antennal joint very small and imbedded with the next joint in the narrow hiatus between the front and the inner suborbital angle; the infra-ocular space being mainly occupied by the lower wall of the orbit."

Family PARTHENOPIDÆ.

Characters of the legion of which it is the only family. The species of this family are often markedly triangular in form; the carapace is usually angular and provided with conspicuous depressions separating the regions. In the characters of the antennæ and also in several other points, the Parthenopidæ approach the Cancroid Brachyura.

Genus **Heterocrypta** *St.*

Carapace triangular, transverse, the lateral margins greatly produced and concealing the ambulatory legs. A conspicuous depression separating the gastric from the cardiac and branchial regions. Rostrum simple. A strongly marked ridge on the pterygostomian regions. Chelipeds greatly developed, trigonal. Posterior margin of the carapace not produced, as in *Cryptopodia*.

Heterocrypta occidentalis *(Dana).*

Cryptopodia occidentalis DANA, Am. Journ. Sci. (2), Vol. XVIII, 1854, p. 430, fig. in text. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 458. GIBBES, Proc. Elliott Soc. Nat. Hist., Charleston, S. C., Vol. I, 1859, p. 36. A. MILNE-EDWARDS, Miss. Sci. au Mex., Vol. I, Pt. V, p. 169.

Lambrus frons-acutis LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 31.

Carapace broadly triangular; rostrum triangular, subacute, not depressed. Median region narrow, the flattened upper surface bounded by two granulated ridges, which converge to a point behind. Cardiac region furnished with a three-sided, pyramidal elevation, the edges of which are usually granulated. Postero-lateral regions large, and furnished with an S-shaped, granulated crest, which extends from near the posterior end of the median region to the acute lateral angles of the carapace; in front of the anterior bend of this crest there is a pair of minute tubercles. Antero-lateral margin straight or slightly concave in front, convex near the middle, the posterior portion passing outwards and backwards, arching over the legs; the teeth on the anterior part are small and irregular, but they become larger posteriorly, where they are furnished with secondary denticles. Postero-lateral margins transverse; posterior margin not produced over the abdominal segments. Outer portion of the orbit with a superior and an inferior fissure. Ischium of the maxillipeds smooth, the antero-internal angle produced; merus small, the surface concave and bearing near the middle a prominent tooth. Chelipeds long, trigonal; the sides of the merus convex, the edges sharply granulate to dentate; carpus with three or four granular lines; hand about as long as the merus, the angles prominent and dentate and the sides concave; pollex short, deflexed; dactyl short, but longer than the pollex, and when closed its outer margin is nearly at right angles to the long axis of the hand. Ambulatory legs compressed, strongly carinated above; dactyls narrow, strongly sulcate, and corneous-tipped. Color reddish.

Length 18 mm.; breadth 28 mm.; length of cheliped 50 mm.

Monterey (Dana); Santa Catalina Island (Lock.)! This species is quite common in Avalon Harbor, Santa Catalina Island. I have examined a specimen in the California Academy of Sciences which I feel confident is Lockington's type of *frons-acutis*.

Genus **Leiolambrus** *Milne-Edw.*

Carapace subtriangular, smooth, with no tubercles or spines on the upper surface. The median and cardiac regions are not separated from each other by a deep depression, but are limited on either side by longitudinal sulci. Front short, truncated, and armed with a small, median tooth. The antero-lateral margins are denticulated and the posterior margin is furnished with teeth or spines. Lateral angles of the carapace prominent and acute. Orbits well defined and furnished with a fissure in the upper and lower margins. Antennules obliquely plicated. Ischium of the maxillipeds produced forward at the antero-internal angle; outer angle of the merus rounded. A ridge on the pterygostomian regions. Chelipeds trigonal, the angles dentate. Ambulatory legs slender, compressed; dactyls slender, depressed.

Type.—*L. punctatissimus* (Owen).

Leiolambrus punctatissimus *(Owen).*

Parthenope punctatissima Owen, Zool. Beechy's Voyage, Crust., 1839, p. 81, Pl. XXIV, fig. 4. Stimpson, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 458. Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 78.
Leiolambrus punctatissimus A. Milne-Edwards, Miss. Sci. au Mex., Vol. I, Pt. V, pp. 148 and 159.

Carapace smooth, convex, minutely punctate; the median and cardiac regions forming a nearly continuous longitudinal elevation, bounded on either side by a conspicuous, longitudinal depression. Front truncated, having a small, median tooth, behind which the upper surface is marked with a short, longitudinal groove. Postorbital angle acute. Antero-lateral margins long, slightly arcuated, and furnished with teeth which become very small toward the anterior end. The sides of the carapace are produced into a prominent, triangular tooth. Two teeth on the posterior margin near the middle line; external to these a pair of larger marginal teeth; the margins between the external pair and the lateral angles of the carapace are concave. The whole posterior margin of the carapace is marked with a delicate, raised, jagged line; another fine raised line running upon the branchial regions from the external tooth of the posterior margin. Maxillipeds smooth, the ischium slightly narrowed distally, the antero-internal angle produced forward into a rounded lobe; merus broadly rounded at the antero-external angle and produced below the articulation of the palp. Chelipeds large; merus with the angles denticulated, the anterior edge bearing several rough teeth; carpus with the angles denticulated, the outer margin acute and dentate; hand longer than the merus, the margins denticulated, the upper margin upturned near the end; pollex nearly longitudinal and almost straight, the inner margin dentate; dactyl curved and provided on the external portion of the base with two converging, denticulated ridges which meet and form a crest on the distal portion. Ambulatory legs smooth, compressed, and subequal in length; dactyls slender, lanceolate, longer than the propodi, and flattened in a plane at right angles to that of the preceding joints.

Locality of specimen described, lat. 27° 45′ N., lon. 110° 45′ W.; 20 fathoms.

Length of carapace	7.25	mm.
Width of carapace	9.5	mm.
Length of hand	7	mm.

Subtribe CYCLOMETOPA, or CANCROIDEA.

Carapace generally broader than long, wide and regularly arcuated in front, rarely quadrate or suborbicular in form; rostrum wanting. Epistome short, transverse. Antennules longitudinal or transverse. Palp of the maxillipeds joined to the apex or inner angle of the merus. Branchiæ nine, the efferent branchial channels as in the Maioidea. Verges of the male in the coxæ.

Section CANCRINI *Ortmann.*

Carapace rounded or widened, a dentate antero-lateral margin sharply marked off from a postero-lateral margin devoid of teeth. Front with several teeth, one of which is median. Antennules longitudinal or oblique.

Genus **Cancer** *L.*

Carapace transverse, subelliptical, indistinctly areolated. Antero-lateral margins regularly arcuated and armed with ten teeth. Front narrow, cut into five teeth or lobes. Eye-peduncles short; orbits small, with two fissures in both upper and lower margins. Antennules longitudinal, or nearly so. Basal antennal joint somewhat enlarged and united with the front, thus excluding the short flagellum from the orbit. Merus of the maxillipeds distally truncated and not produced at the antero-external angle. Chelipeds subequal, the hand generally costate on the outer surface.

Key to the Species.

- Carapace not undulated; size small .... *C. gracilis.*
- Carapace undulated, large species.
  - Antero-lateral teeth distant, the posterior one the largest .... *C. magister.*
  - Antero-lateral teeth contiguous.
    - Front flattened and produced .... *C. productus.*
    - Front not flattened nor produced .... *C. antennarius.*

Cancer productus *Randall.*

Cancer productus Randall, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 116. Dana, Crust. U. S. Expl. Expd., Part I, 1852, p. 156, Pl. VII, fig. 3. Stimpson, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 461. Bate, in Lord's Nat. in Vancouver's Island, Vol. II, 1866, p. 269. Lockington, Proc. Cal. Acad. Sci , Vol. VII, 1877, p. 95. Smith, Rep. Prog. Geol. Sur. Canada, 1879, *B*, p. 207. Rathbun R., The Fisheries of the U. S., Sec. 1, 1884, p. 771, Pl. CCLXII. Ortmann, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 425. Calman, Ann. N. Y. Acad. Sci., Vol. XI, 1898, p. 262.

Platycarcinus productus Gibbes, Proc. Am. Ass. Adv. Sci., 1850, p. 177.

Cancer perlatus Stimpson, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88.

Carapace usually wide, undulated above. Hepatic regions depressed. Front flattened, produced into five, generally obtuse teeth which lie in the same horizontal plane, the outermost pair not more widely separated from the inner pair than these are from the median tooth. Superior margin of the orbit between the two fissures not produced into a tooth, as in *antennarius;* external orbital tooth small, the next one behind it rounded; succeeding teeth becoming larger and more acute posteriorly, the last tooth, in adult specimens, being the largest. Between the teeth the margin of the carapace is marked with short, closed fissures. The tooth on the lower margin of the orbit small or absent. Flagellum of the antennules considerably shorter than the width of the front. Merus of the maxillipeds obliquely truncated at the distal end and notched on the inner side at the articulation of the palp. Carpus of the chelipeds with a large tooth at the antero-internal angle and a smaller one behind the upper hinge joint; the outer surface is roughened with several irregular prominences; hand with a double row of tubercle-like teeth on the upper edge and four or five granulated costæ on the outer surface, the upper ones of which are the most obscure; fingers stout and tipped with black, the dactyl not cristate above. Ambulatory legs nearly naked, except the dactyls which are slender and a little longer than the propodi. Terminal abdominal segment in the female nearly equilaterally triangular, the sides concave. In the male this segment is more narrowly triangular than in the other sex. Color dark reddish above; below a dirty white.

Length of large specimen, male........................	85 mm.
Breadth of large specimen, male........................	131 mm.
Length of small specimen, female	22.5 mm.
Breadth of small specimen, female.....................	33.5 mm.

Dr. Stimpson has given a table of measurements of specimens of different sizes and sex, showing that the males are wider than the females and the old males relatively wider than the young ones. The proportion of length to breadth was found to vary from 1: 1.30 in a male .99 in. in length to 1: 1.63 in a male of 2.95 in. in length. The young of this species differ in many respects from the old specimens. The carapace is much flatter and smoother, and ornamented above with numerous longitudinal, colored lines which entirely disappear in the adult. The teeth of the front are represented by five subequal crenulations. The teeth on the antero-lateral margin are much less distinct, being represented on the anterior portion by low crenulations which become more acute behind. In the adult the posterior tooth may curve forwards but not so sharply as in *antennarius*. Secondary denticles are nearly obsolete. The granules on the carapace are of unequal size, being generally larger and sharper on the median region. In the females the carapace is generally more convex than in the males.

Queen Charlotte Island (Smith), Vancouver Island (Bate), Puget Sound (Dana), Oregon. Common on the entire California coast to Lower California.

Cancer antennarius *St.*

Cancer antennarius STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 462, Pl. XVIII. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 96. SMITH, Rep. Prog. Geol. Sur. Canada, 1879, *B*, p. 207. RATHBUN R., The Fisheries of the U. S., Sec. 1, 1884, p. 771, Pl. CCLXIII. MIERS, Challenger Reports, Vol. XVII, 1886. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 425.

Platycarcinus recurvidens BATE, Proc. Zool. Soc. London, 1864; Ann. Nat. Hist. (3), Vol. XV, p. 488; in Lord's Nat. in Vancouver's Island, Vol. II, 1866.

Carapace undulated, smooth, widest at the penultimate antero-lateral tooth, the granulations on the surface minute and even. Front not produced, the three median teeth separated from the outermost pair which is the largest. The middle tooth is smaller than those on either side and situated a little below them. A tooth on the superior margin of the orbit between the two fissures. The tooth on the basal antennal joint projects further forward than the lateral tooth of the front and there is quite a prominent tooth on the inferior orbital margin just external to it. The postorbital is the smallest of the antero-lateral teeth but is relatively much larger than in *productus*. The teeth of the antero-lateral margin are large and have the tips sharp (except when worn) and curved forward; on the margins of the teeth, especially the anterior margin, there are usually small, sharp, secondary denticles. There are but nine large antero-lateral teeth, the tenth being probably represented by a small projection behind the last large tooth. Flagellum of the antennæ usually long, generally exceeding the width of the front. Distal margin of the merus of the maxillipeds nearly transverse and gently convex; inner margin notched. Chelipeds stout; carpus with a stout tooth at the antero-internal angle and a smaller tooth behind the superior hinge joint; the external surface is smooth in old specimens but roughened, granulated and pubescent in younger ones. The hand is longitudinally costate on the external surface in young specimens but the costæ disappear with age; the fingers are smooth and tipped with black. Ambulatory legs very hairy or nearly naked; the dactyls pubescent and a little stouter than in *productus*.

Length of carapace, male	76 mm.
Breadth of carapace, male	113.5 mm.
Length of carapace, female	73 mm.
Breadth of carapace, female	107 mm.

The young of this species are relatively much less wide than the adults and have the carapace and appendages thickly covered with hair. The hair on the upper surface disappears with age and in old specimens the appendages may become nearly naked. The postorbital tooth in young specimens is fully as large as those behind it. This is a well marked species and may easily be distinguished from the other species on our coast by the sharply recurved antero-lateral teeth.

Queen Charlotte Island (Smith), Vancouver Island, Oregon, northern to Lower California! Common.

Cancer magister *Dana.*

Cancer irroratus RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 116.

Cancer magister DANA, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 78; Crust. U. S. Expl. Expd., Part I, 1852, p. 151, Pl. VII, fig. 1. STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 458. COOPER, Rep. Expl. Sur. Pac. Ocean, Vol. XII, 1860, p. 387. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 94. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B.*, p. 206. RATHBUN R., The Fisheries of the U. S., Sec. 1, 1884, p. 770, Pl. CCLXI.

Metacarcinus magister A. MILNE-EDWARDS, Ann. Sci. Nat. (4), T. XVIII, 1862, p. 33, and (5), T. I, 1864, p. 67; Nouv. Archiv. Mus. Hist. Nat. Paris, T. I, 1865, p. 202, Pl. XIX, fig. 1. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 424.

Carapace gently convex, undulated, and covered with small granulations which are larger on the summits of the prominences. Two or three curved rows of light colored spots on the antero-lateral regions. Front not produced, the three median teeth small, the middle one being slightly the largest and projecting further forward than the others; outermost pair larger than the others, not reaching so far forwards, and separated from them by a considerable interval. No tooth on the superior orbital margin. Basal antennal joint large, its pointed extremity projecting much further forward than the outer tooth of the front. A small tooth on the inferior margin of the orbit just external to the basal antennal joint. Antero-lateral margin armed with ten distant teeth which decrease in size and become more closely set anteriorly; the teeth are triangular in shape and the margin between them is denticulated or sharply granulated; the posterior tooth is the largest of the series, its anterior margin is generally transverse and its posterior margin continuous with the postero-lateral margin of the carapace. Postero-lateral margin nearly straight (the anterior part slightly convex, the posterior a little concave) and devoid of a tooth or projection behind the large lateral tooth. Merus of the maxillipeds very obliquely truncated at the distal end, the antero-internal angle rounded, and the inner margin concave (not deeply notched) behind the articulation of the palp. Chelipeds slightly unequal; merus armed with two teeth at the distal end, one on the margin, and one a short distance behind it; the outer surface of the carpus furnished with granulated ridges, the upper one running to a sharp spine at the antero-internal angle; upper surface of the hand furnished with a prominent crest, which is cut into numerous sharp teeth; outer surface with five longitudinal, granulated costæ; fingers more slender than in the preceding species and furnished with more numerous teeth; dactyl armed with a dentate crest on the upper margin. Legs granulated, carpi sulcate above; dactyls strongly compressed, those of the fifth pair widened.

Length of adult specimen	78 mm.
Breadth of adult specimen	106 mm.

Alaska, Queen Charlotte Island (Smith), Puget Sound, Oregon, northern to Lower California.

This species is common in and around San Francisco Bay, where it is caught in large numbers for food. It is the common crab of the markets.

Cancer gracilis *Dana.*

Cancer gracilis DANA, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 73; Crust. U. S. Expl. Expd., Vol. I, 1852, p. 153, Pl. VII, fig. 2. STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 460. COOPER, l. c., 1860, p. 389. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 95. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1892, p. 23.

Carapace quite strongly convex, finely granulated and not undulated. Front not produced; the three median teeth reach further forward than the outer pair; the central tooth is smaller than the others but projects farther anteriorly. No tooth on the superior orbital margin. Postorbital tooth larger than the ones behind it, which are low, triangular and subequal in size. A small tooth on the nearly straight posterior margin. The pointed extremity of the basal antennal joint does not extend nearly so far forward as in the preceding species. A rounded lobe on the inferior orbital margin just external to the basal antennal joint. Merus of the maxillipeds distally rounded. Merus of the chelipeds with the distal extremity of the upper margin armed with two teeth as in *magister;* carpus ridged on the outer surface as in *magister* and having a strong spine at the antero-internal angle, and another spine below it; the upper edge of the hand is acute and may bear a few teeth, but it is often edentulous; the outer surface furnished with granulated costæ, which sometimes become quite faint. The fingers resemble those of *magister;* the upper margin of the dactyl is acute but not dentate; legs long, nearly naked, the dactyls slender, compressed.

Sex.	Length of Carapace.	Breadth.	Proportion.
Male	1.51 in.	2.30 in.	1: 1.52
"	1.60 in.	2.40 in.	1: 1.50
"	1.70 in.	2.55 in.	1: 1.50
Female	1.90 in.	2.80 in.	1: 1.47
"	1.45 in.	2.13 in.	1: 1.47

The males therefore appear to be relatively wider than the females.

Vancouver Island (Newcombe), Puget Sound, Tomales Bay, San Francisco Bay! San Pedro! San Diego!

This is one of the smallest species of the genus *Cancer* and it is also the rarest of our species. It is more closely allied to *magister* than to the other forms, but may be easily distinguished from that species by the greater convexity and smoothness of the carapace, the character of the antero-lateral teeth and its smaller size.

Genus **Trichocarcinus** *Miers.*

(*Trichocera* De Haan preoccupied.)

Carapace cancroid in form, the sides rounded; antero-lateral margins not sharply marked off from the postero-lateral; upper surface very uneven. Front with five teeth. Antennules nearly longitudinal. Antennæ quite long, setose on all sides, the first joint elongated and occupying the inner orbital hiatus. Abdomen of the female seven-jointed; in the male five-jointed, the third, fourth and fifth joints fused. Crabs of small size.

Type.—T. gibbosula **(De Haan.)**

Although this genus was formerly placed among the Corystoid crabs it is in many respects, as Miers has observed, quite closely allied to the genus *Cancer*. *Cancer antennarius* shows many characters in common with this genus.

Trichocarcinus Walkeri (new name).

Trichocarcinus recurvidens **Walker, Trans. Liverpool Biol. Soc., Vol. XII 1898, p. 271, Pl. XV, figs. 1-1*b*.**

"Carapace 19 mm. long by 23 mm. wide, divided into a number of prominent areolæ of which the surfaces are flattened and granulated; they are separated by deep interspaces. * * * The antero- and postero-lateral margins are ill defined; the former has ten teeth (including the orbital) which are convex on the upper surface, widening distally, and inclined upwards, whence probably the specific name. * * * Eye-stalks short with a bifid calcareous appendage on the upper and inner side. * * * Differs from *T. oregonensis* (Dana) in the flatter, more sharply defined areolæ, in the distal expansion of the teeth of the antero-lateral margin, and in the different form of the calcareous ocular appendage. Color of areolæ bright red, chelipeds and legs flesh color, fingers black. One male."

Puget Sound.

The specimen described by Mr. Walker was referred by him to Bate's species only with great hesitation, as Bate's "imperfect description would apply quite as well to *T. oregonensis*." The determination is made solely on the ground that Bate calls *recurvidens* a "pretty species"—a term which applies better to Walker's specimen than to the less attractive species of Dana. I do not believe, however, that Walker's identification is correct, as Bate says that *recurvidens* "may be distinguished by the sharp points of the inner lateral teeth, granulated or minutely baccated along the margin and having the apex recurved." The teeth of the specimen described by Walker, instead of being sharp pointed, are distally widened with a wide, transverse, distal margin. The form that Mr. Walker describes has, therefore, been given a new specific name. Bate's species may be *T. oregonensis* or, as Miers has suggested, the young of *Cancer antennarius* Stimpson.

Trichocarcinus oregonensis *Dana.*

Trichocera oregonensis DANA, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 86; Crust. U. S. Expl. Expd., Part I, 1852, p. 299, Pl. XVIII, fig. 5. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 464. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471.

Trichocarcinus oregonensis MIERS, Proc. Zool. Soc. London, 1879, p. 34; Challenger Reports, Vol. XVII, 1886, p. 110. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 207. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 24. WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 271, Pl. XV, fig. 2.

Carapace elliptical, evenly rounded at the sides; areas distinct and elevated, especially in front, and covered with rounded granulations; sulci between the elevations wide, deep and smooth, especially on the anterior portion of the carapace. The front does not project beyond the line of the orbits; the outer pair of teeth (preorbital) are lobe-like, having a broad, granulated edge, and are separated from the inter-antennary portion of the front by a deep, concave notch; the median portion of the front is very short, truncated, and obscurely divided by a slight incision on either side of the center into a small median tooth and two larger lateral ones. A tooth between the two fissures in the superior margin of the orbit. Antennules nearly longitudinal, the fosettes extending nearly to the margin of the front. Basal antennal joint not strongly produced at its distal end; second joint broad, flattened, distally expanded and provided with a tuft of long setæ at the distal end; third joint subcylindrical and about as long as the preceding; flagellum long and hairy. A small tooth on the inferior margin of the orbit next to the inner fissure. Eye-stalks with a small tooth on the anterior surface. Sides of the carapace armed with ten to thirteen closely set, granulated teeth which extend upon the postero-lateral margin; in front of the rounded lateral angles the teeth are strongly upturned and bent forwards; alternate teeth are the more acute; the first sharp tooth the third from the front. Antero-external of the merus of the maxillipeds produced; the inner margin notched behind the articulation of the palp. Chelipeds very stout; merus about as wide as long; carpus granulated on the outer side, the granules becoming larger above where there may be a few small tubercles; a spine at the antero-internal angle below which there is a tooth; hand thick and high; the short upper edge of the palm bears two rows of small tubercles and on the outer surface there are five delicate, granulated lines, the two lower lines the finest and continued upon the short, thick pollex; both fingers dark colored. Legs hairy; dactyls about as long as the propodi. Sixth abdominal segment in the male nearly square, the last narrowly triangular.

Length of carapace, male	17 mm.
Breadth of carapace, male	21 mm.

Mutiny Bay, Alaska! Queen Charlotte Island, Vancouver's Island, British Columbia, Gulf of Georgia, Puget Sound, northern to Lower California! From low tide mark to several fathoms in depth.

Miss Mary Rathbun has recently united *Trichocarcinus* with the genus *Cancer* and reports two Japanese species, *gibbosulus* (De Haan) and *amphiœtus* (=*Trichocarcinus dentatus* Miers), from California.[1] *Oregonensis* is closely allied to De Haan's species.

Section XANTHINI *Ortmann.*

Carapace rounded or subquadrate. Front wide and generally divided by a median notch. Antennules oblique or transverse.

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[1] See Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 581.

Genus **Cycloxanthops** *Rath.*

Front horizontal, produced, and divided by a median fissure into two deep, lamellate lobes, which are truncated and separated from the inner orbital angle by a rather deep fissure. Orbits small, with the superior margin marked by two fissures. The postorbital angle is only slightly prominent and is continuous with the antero-lateral margin, which is strongly curved behind. Basal antennal joint short, but joined at its internal angle to the front; the flagellum is inserted in the inner orbital hiatus. Merus of the maxillipeds subquadrate, the anterior margin not oblique. The abdomen in the male is composed of five free joints.

Type.—C. sexdecimdentatus (EDW. & LUCAS).

The genus *Cycloxanthus* was established by Milne-Edwards[1] to receive some species of fossil crabs. Finding subsequently that this species was a synonym of *Zanthopsis* M'Coy, Edwards applied the name *Cycloxanthus*, which he considered as having thus become "disponible," to an entirely different genus of which he made *sexdecimdentatus* the typical species.[2] According to the rule, "Once a synonym always a synonym," the name *Cycloxanthus* is no longer available for use.

Cycloxanthops novem-dentatus *(Lock.)*

Xanthodes ? novem-dentatus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 32.

Xantho novem-dentatus LOCKINGTON, *Ibid.*, 1877, p. 99. KINGSLEY, Proc. Bost. Soc. Nat. Hist., Vol. XX, 1879, p. 153.

Cycloxanthus californiensis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 237.

Carapace wide, flattened, and more or less punctate behind; convex, granular and rugose in front. Median region divided into three well-defined regions by distinct sulci; branchial regions divided by a transverse sulcus arising from the lateral angles. Front horizontal, produced, edentate, with the anterior margin nearly transverse, but a little advanced in the center, and divided by a deep, closed, median notch which may become obliterated above by the fusion of the two sides; the anterior margin of the lobes may be straight, or, more often, slightly concave; seen from in front they are gently arched upward, or in some cases very strongly so. Antero-lateral margin armed with eight or nine small subacute teeth whose bases are generally narrower than the spaces between them; postorbital tooth small; next tooth also small, depressed and often lobate, and separated from the postorbital by a considerably greater interval than from the succeeding tooth; at the rounded sides of the carapace the teeth become larger, more acute, and more closely set. There is a tendency to alternation in the size of the teeth; the fourth tooth, counting the postorbital, is larger than the fifth, and the sixth and eighth are larger than the seventh; ninth tooth small and situated behind the lateral angle; a small tenth tooth often occurs closely behind the ninth. On the outer margin of the orbit above the postorbital tooth there are two small, blunt teeth separated by a narrow fissure; preorbital tooth distinct; suborbital lobe acute. Basal joint of the antennules with a pronounced ridge on the outer surface with a groove on either side. Merus of the maxillipeds obliquely truncated at the anterior end. Merus of the chelipeds hairy above; carpus rugose, and furnished with two blunt teeth at the antero-internal angle; hand rugose above, and rather long, with the upper and lower margins nearly parallel; fingers long, sulcate, not gaping, and colored brown, with light colored tips. Legs with the margins hairy;. dactyls longer than the propodi and terminating in nearly straight, corneous claws. Abdomen in the male narrow, the second joint a little over a half longer than wide, penultimate joint longer than wide; last joint about as long as broad, with the distal end rounded. In the abdomen of the female the second joint is longer than the third or fourth, which are subequal and shorter than the fifth; sixth joint the longest, nearly equaling the third and fourth combined; last joint broader than long, and in adult specimens broadly rounded at the tip.

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[1] dans d'Archiac, Hist. des progr. de la géologie, T. III, p. 304, K.

[2] Ann. Sci. Nat. (4), T. XX, 1863, pp. 278 and 307.

The following measurements are from a series of specimens from San Diego, California:—

	Length of Carapace.	Width of Carapace.
Male.	25.75 mm.	38.75 mm.
"	25 mm.	37.5 mm.
"	24 mm.	35.25 mm.
"	23 mm.	35 mm.
"	22 mm.	32 mm.
"	20 mm.	30 mm.
"	18 mm.	26 mm.
"	14.75 mm.	21 mm.
"	12 mm.	17 mm.

	Length of Carapace.	Width of Carapace.
Female.	26 mm.	40 mm.
"	21.75 mm.	32 mm.
"	15 mm.	21.5 mm.
"	11 mm.	16 mm.

One large specimen from southern California (precise locality unknown) measured 36.25 mm. by 56.75 mm.

San Pedro! San Diego! southern California! Catalina Harbor (Rathbun, M.), Guadalupe Island, Lower California (Rathbun, M.), San Clemente Island!

This is a very common species on the coast of southern California. I have not seen Lockington's type, which could not be found in the Academy, but there were other specimens in Lockington's collection which bore the name *Xantho vittata* St. written above the earlier name *Xantho novem-dentatus* which had been partly scratched out. I have seen the types of *Cycloxanthus californienis* and compared them with specimens I had identified as *novem-dentatus* by a comparison with the specimens in Lockington's collection. There is, I believe, no doubt that the two species are identical. This species is closely allied to *vittatus* St., but I think we must accept Miss Rathbun's conclusion, that it is distinct, although it was considered a synonym of the latter species by Milne-Edwards and subsequently by Lockington himself. At the National Museum in Washington I had the opportunity of comparing specimens of *vittatus* from the western coast of Mexico with several specimens of this species. The former species differs in its longer and sharper lateral teeth, its broader hands, and its narrower abdomen.

Cycloxanthops rugosa, sp. nov.

Carapace very uneven, granulated, and thickly covered with small, circular pits. Postorbital tooth small; antero-lateral teeth irregular. Anterior portion of the subhepatic region prominently granulated and pitted and not sharply separated from the strongly sloping anterior portion of the hepatic area. Front shorter and more depressed than in *novemdentatus*. External maxillipeds much as in the preceding species; merus pitted and granulated. Carpus of the chelipeds strongly reticulated above; a prominent tooth at the antero-internal angle, below which is a smaller tooth. Hands narrow, strongly reticulated above and on the upper portion of the outer surface, the inner margin of the upper side furnished with several irregular tubercles. Ambulatory legs much as in *novemdentatus* but less hairy.

San Diego, California. Collected by A. U. Crawford.

Described from a specimen in the museum of the University of California. Easily distinguished by the conspicuous pits and prominent granulations of the carapace.

Genus **Lophoxanthus** *A. Milne-Edwards.*

Carapace broader than long, flattened, the anterior portion of the antero-lateral margins straight, nearly devoid of teeth, and meeting the dentate posterior portion at an angle. Front short and divided by a median fissure into two broad, truncated lobes. Orbits nearly circular and marked with fissures which are closed or even obsolete. Basal antennal joint short and in contact with the infero-lateral process of the front, but not entering the inner orbital hiatus. Maxillipeds nearly quadrate, the merus distally truncated, the antero-external angle not produced. Ambulatory legs compressed and carinated or crested above. Abdomen in the male five-jointed.

Type.—L. lamellipes (STIMPSON.)

This genus is doubtfully distinct from *Lophozozymus*, being distinguished chiefly by its more transverse carapace and the absence of conspicuous teeth on the anterior portion of the antero-lateral margins. The three species of this genus here described are closely allied. In all these the areolation of the carapace is distinct, the postorbital tooth minute, the anterior half of the antero-lateral margin straight and furnished with a single low, obscure tooth, the posterior half nearly longitudinal and furnished with three, prominent, subequal teeth, the epistome with a ridge extending upon it from the sides, the inferior inner orbital tooth pointed, and the tooth external to the latter obtuse and separated from the postorbital by a fissure, the upper margin of the orbit furnished with two fissures, the merus of the maxillipeds rectangular, notched behind the articulation of the palp, and crossed by an oblique ridge, the chelipeds stout, the merus trigonous and dentate above near the distal end, the carpus rounded and furnished with a tooth at the inner angle, the hands with a lobe pointing inward at the base of the upper side of the palm, the fingers irregularly dentate within but with the outer margins rounded; the ambulatory legs furnished above with lobulated crests on the carpi and propodi, the dactyls slender and villous, the second segment of the abdomen narrowed distally, the third segment wider at the base than the distal end of the second and touching the coxæ of the fifth pair of legs, the last two segments of subequal width, the terminal joint rounded.

Lophoxanthus bellus *(Stimpson).*

Xantho bella Stimpson, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 204, Pl. III, fig. 2. Bate, in Lord's Nat. in Vancouver's Island, Vol. II, 1866, p. 270. Newcombe, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 24.

Xanthodes Hemphillii Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 31.

Xanthodes Hemphilliana Lockington, l. c., 1877, p. 100.

Lophoxanthus bellus A. Milne-Edwards, Crust. Miss. Sci. au Mex., Pt. V, p. 256, Pl. XLVI, fig. 4.

Lophozozymus (Lophoxanthus) bellus Miers, Challenger Reports, Vol. XVII, 1886, p. 115.

Lophopanopeus bellus Rathbun M., Bull. Lab. Nat. Hist., Univ. Iowa, 1898, p. 272.

Carapace flattened behind, convex in front, and transversely nearly plane; surface distinctly areolated, becoming roughened toward the antero-lateral margins. Front generally sinuate, and divided by a median fissure, the outer angles produced into small rounded lobes or teeth, which are separated from the adjacent supraorbitals by a fissure. Postorbital tooth small. The anterior half of the antero-lateral margin is nearly straight, meeting the posterior half at an angle, and furnished with a single low, inconspicuous tooth which is sometimes absent; posterior half furnished with three prominent, subequal, horizontally flattened teeth, the anterior one the least acute. Postero-lateral margins nearly straight, rapidly converging. The infero-internal angle of the orbit is produced into a prominent pointed tooth; a broad lobe-like tooth at the infero-external angle of the orbit separated from the postorbital above by a fissure. Merus of the maxillipeds subrectangular, the surface with two depressions separated by an oblique elevation. Chelipeds stout, the upper margin of the merus furnished with a few irregular teeth; surface of the carpus more or less roughened, the antero-internal angle furnished with a tooth which is

typically double, the lower cusp obscure; hands rounded above and furnished with a lobe projecting inward at the intero-proximal portion of the upper side; fingers black or dark brown. Abdomen in the male five-jointed, the last segment rounded and slightly wider than the preceding one, which is somewhat wider than long. Merus of the ambulatory legs acute above; carpus with a bilobed crest; crest of the propodus often with a lobe at the base; dactyls villous. Color purplish, the legs crossed with light-colored bars.

Found among rocks at low tide from British Columbia to Monterey. Vancouver Island (Bate, Newcombe), Puget Sound (Stimpson)! northern California! Monterey (Stimpson, Lockington)!

Locality.	Length.	Width.
Puget Sound; male	19 mm.	26.5 mm.
Puget Sound; female	15.75 mm.	22.5 mm.
Monterey; male, type of *Hemphillii* LOCK.	18.75 mm.	28 mm.

Two specimens whose measurements are given by Stimpson were .54 by .80 in. and .56 by .89 in. "Northern specimens," says Stimpson, "are more transverse, rougher, more pubescent, and more sober in coloration than those found in warmer latitudes." Possibly specimens of *leucomanus* or *frontalis* were confused with this species. I have seen Lockington's type of *Hemphillii* (No. 35) which is preserved in the collection of the California Academy of Sciences. It is a typical *bellus* and as strongly transverse and as rough as the specimens I have seen from farther north. The specimen from Lower California which is figured as *L. bellus* by A. Milne-Edwards (l. c.) probably belongs to a different species.

Lophoxanthus leucomanus *(Lock.)*

Xanthodes leucomanus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, pp. 32 and 100.

Lophoxanthus bellus A. MILNE-EDWARDS, Crust. in Miss. Sci. au Mex., Pt. V., p. 256 (in part).

Lophopanopeus leucomanus RATHBUN M., Bull. Lab. Nat. Hist. Univ. Iowa, 1898, p. 272.

Closely allied to *bellus*, but having the anterior portion of the antero-lateral margin not so nearly transverse, the surface of the carapace more eroded, the lateral teeth narrower and more nearly conical, the ambulatory legs somewhat more slender and more prominently crested. The areolation of the carapace is plain; the front is produced more than in *bellus*, and divided by a median notch, the lobes sinuate with the outer angles produced as in the preceding species. Orbital fissures and teeth as in *bellus;* lateral teeth of the carapace subconical, prominent and subequal, the anterior one least acute. Subhepatic regions eroded, especially near the orbits. Chelipeds unequal; merus irregularly dentate on the upper margin; carpus and upper surface of the hand generally eroded or furnished with a network of raised lines; hand with a lobe at the base as in *bellus;* fingers light to dark brown. Merus of the ambulatory legs with an acute upper margin which usually ends in a tooth near, but not at the distal end; carpus with a bilobed crest above; crest of the propodus with a lobe near the base. Dactyls rather slender.

Locality.	Length.	Width.
Monterey, *male*.	13.5 mm.	18.5 mm.
Santa Catalina Island, *male*.	12.5 mm.	17.75 mm.
Southern California, *male*.	8.5 mm.	11.25 mm.
" " *female*.	11.25 mm.	14.75 mm.
West America, *male*.	13.5 mm.	18 mm.
" " *female*.	10 mm.	13 mm.
" " "	10 mm.	13 mm.
La Paz, Lower California, *male*.	7.75 mm.	10 mm.
" " " " "	6.5 mm.	8.5 mm.
" " " " *female*.	7 mm.	9 mm.

Monterey (Lockington)! Santa Catalina Island! San Diego and Santa Rosa Island (Lockington), La Paz, Lower California (Lockington)! "Southern California," two specimens (No. 17286 U. S. National Museum)! San Clemente Island! San Diego!

This species varies considerably as regards the roughness of the carapace and legs. In some cases the anterior part of the carapace and the upper side of the carpus and manus of the chelipeds are very much eroded, but occasionally they are nearly smooth; the tubercle on the middle of the surface of the maxillipeds is often prominent, but in some specimens it is quite inconspicuous. The crests on the ambulatory legs are also quite variable, and the tooth at the end of the sharp upper edge of the merus may be absent. These differences are probably due, in great measure, to age.

The forms from near Japan which Miers identified with this species under the name *Lophozozymus (Lophoxanthus) bellus* St. var. *leucomanus* Lock. belong, I believe, to a distinct species. The lateral teeth in Miers' form are quite different from *leucomanus*; the hands, as shown in Miers' figure, lack the lobe at the base of the palm; "the mobile finger is longitudinally carinated and sulcated above," while in *leucomanus* it is rounded and perfectly smooth; the pits on the upper side of the hand are arranged in longitudinal series, but in *leucomanus* this arrangement is not shown.[1]

The types of *leucomanus* are probably no longer preserved. I have specimens from localities from which this species was reported by Lockington, and I have seen Lockington's specimens from La Paz, Lower California.[2] These specimens are small and strongly eroded, but present no well-marked differences from the northern forms.

None of the specimens of *leucomanus* I have seen attain nearly the size reached by *bellus*.

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[1] See Challenger Reps., Vol. XVII, p. 115, Pl. XI, fig. 1.

[2] See Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 100.

Lophoxanthus frontalis *(Rathbun).*

Lophozozymus (Lophoxanthus) frontalis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 236.

Lophopanopeus frontalis RATHBUN M., Bull. Lab. Nat. Hist., Univ. Iowa, 1898, p. 272.

Closely allied to the two preceding species, especially to *leucomanus*. The shape of the carapace is nearly the same as in the preceding species, but the upper surface is smoother, not eroded, the lateral teeth more flattened horizontally and slightly upturned; the areolation is plain; the subhepatic regions are granulated but not eroded. Front considerably produced, sinuate, the median notch deep. Orbits and orbital teeth as in *leucomanus*. Maxillipeds granulated, the merus shaped as in the two preceding species, and crossed by an oblique elevation. Chelipeds unequal; merus with a few teeth on the upper margin; carpus rugose or nearly smooth, with a tooth at the inner angle and a tubercle at the base on the upper side; hands large, with a lobe pointing inward at the base of the upper side of the palm; fingers brown, the color extending far back on the hand. Legs rather slender, more or less hairy, the upper edge of the merus acute but having no well-marked tooth near the end; crests of the carpus and propodus as in *leucomanus* but less prominent; dactyls slender. Length of carapace 15 mm.; width 20 mm.; length of larger hand 16 mm.

Described from a specimen from San Diego sent by Miss Rathbun (No. 19823, U. S. National Museum).

San Diego (Rathbun)! Monterey (Rathbun).

This species may readily be distinguished from *bellus* by its different shape; the portion of the carapace lying in front of a line connecting the tips of the first lateral teeth is about one-fourth the length of the whole carapace in *bellus*, and about one-third of this length in *leucomanus* and *frontalis*. The color of the fingers extends far back upon the hands in this species, while in both the preceding it does not extend further back than the base of the fingers. The front is much more produced than in *bellus*. The hands and carpal joints of the chelipeds are, like the carapace, much less eroded than in *leucomanus*, and the merus of the maxillipeds has the oblique ridge low and flattened and not raised into a tubercle in the center.

Genus **Xanthias** *Rathbun.*

(Genus *Xanthodes* DANA, preoc.)

Carapace transverse, distinctly areolated, more narrow and convex than in the genus *Xantho*, to which it is very closely allied. Antero-lateral margin not thin-edged or cristiform; teeth tuberculiform or even spinous. Posterior portion of the carapace depressed. Antennules transversely or obliquely plicated. Basal antennal joint short, and barely reaching the slender, narrow, infero-lateral process of the front, and not produced within the hiatus of the orbit; flagellum not excluded from the orbit. Chelipeds stout, the tips of the fingers acute (not excavated within). Ambulatory legs compressed or subcylindrical and devoid of a crest on the upper margin. Abdomen of the male five-jointed.

Xanthias Taylori *St.*

Xanthodes Taylori STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1859, p. 208, Pl. III, fig. 3. STREETS and KINGSLEY, Bull. Essex Inst., Vol. IX, 1878, p. 105. A. MILNE-EDWARDS, Crust. in Miss. Sci. au Mex., Pt. V, p. 260, Pl. XLV, fig. 3.

Xantho spini-tuberculatus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, pp. 31 and 99.

Carapace flat behind; in front quite strongly convex longitudinally but transversely nearly plane. Areolets distinct and embossed anteriorly; antero-lateral regions strongly lobulated with a prominent, smooth, rounded lobule above each marginal tooth. The lobes of the front are separated by a wide, rounded notch and furnished with a rounded tooth at the inner and outer angles, between which are several small, baccate protuberances. Closely behind and parallel with the anterior margin of the front is a baccated ridge interrupted in the middle by the prominent longitudinal groove which extends backwards from the median notch. Behind this ridge is another elevation not so distinctly baccated, which is separated by a transverse sulcus from the elevated anterior margins of a pair of lobules lying behind it. Median region divided into three distinct areas. Inner orbital angle prominent and separated by a deep notch from the outer angle of the front. Upper orbital margin with a rounded tooth bounded by a pair of sulci. Postorbital tooth small and continuous externally with a rounded protuberance; the latter is separated by a smooth sulcus from a pair of smooth, rounded prominences, one of which is situated directly above the other. The three posterior teeth on the antero-lateral margin prominent, the last two acute and curved forwards, the first obtuse and generally more or less bifid. A small tooth usually present behind the one at the antero-lateral angle. A tooth below the inferoorbital fissure, and a prominent, subacute tooth at the infero-internal angle. Ocular peduncle with a few baccations in front. Antennules transversely plicated, the basal joint with a granulated or baccated ridge. Basal antennal joint short but touching the outer angle of the front. Merus of the maxillipeds subrectangular, transversely truncated in front, with the outer angle rounded and slightly produced. Chelipeds stout, more or less unequal; merus trigonal, with the distal portion of the upper margin armed with a few spine teeth; carpus thickly covered with prominent, rounded, smooth, glossy, rose-colored tubercles; hand oblong, with the palm longer than wide, the upper and outer surface covered with rose-colored tubercles like those on the carpus, arranged in seven or eight longitudinal rows; fingers stout and colored black, the color not extending back upon the hand. Legs compressed, thickly covered with stiff setæ and strongly spinous, especially on the merus and propodus; dactyls about as long as the propodi. Abdomen of the male five-jointed, the penultimate joint about as long as wide; last joint broadly rounded.

Length of carapace 13 mm.; breadth 19.5 mm.

Monterey (Stimpson)! Santa Rosa! San Pedro! San Diego! Santa Catalina Island! Magdalena Bay and San José Island (Lockington).

"This species," says Lockington, "appears to be of common occurrence from Monterey southward to Magdalena, but to disappear, or at least to become rare, in localities further south."

Xanthias latimanus *(Lock.)*

Xanthodes latimanus Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 31.
Xantho latimanus Lockington, l. c., p. 101.

Lockington's description of this species is as follows: "Front sinuate, the inner angle of the orbit raised into a point; carapax but slightly transverse; teeth N. T. S. prominent and pointed, D and E almost obsolete; areolation of medial and antero-lateral regions distinct, the former having the parts 2M and 3M entirely outlined. Hands subequal, the right somewhat the larger; movable fingers very long and curved abruptly downward; margin of manus continuous with the broad base of the fixed finger so as to form a sinuous sloping line; hinder feet compressed. This species may readily be identified by the delicate marbling of the carapace and chelipeds, and the downward bend of the movable fingers. Abdomen of male five-jointed.

"A single male specimen from San Diego.

"Length 0.73; breadth 0.88 [inch]."

I have never seen this species and the description is not sufficiently complete to enable one to determine whether or not it belongs in the genus in which Lockington placed it. Professor A. Milne-Edwards considers it identical with Stimpson's *Micropanope latimana*. Milne-Edwards does not mention having seen *latimana*, and as he simply transcribes Stimpson's description it is quite certain that he bases his identification solely upon the descriptions of the two authors. The identification is not improbably correct, but considering the brevity of both the descriptions, it is somewhat unsafe to unite the two species, especially since the characters mentioned by Stimpson are mainly those of which Lockington says nothing.

Genus **Pilumnus** *Leach.*

Carapace convex, little broader than long, and hairy above. Antero-lateral margins regularly arcuated, shorter than the postero-lateral, and armed with short spines. Front narrow, emarginate. Endostome longitudinally carinated. Basal antennal joint short, barely reaching the infero-lateral frontal process and lying under the orbit. Ambulatory legs compressed, not carinated, and armed with spinules; dactyls slender, nearly straight. Abdomen of the male seven-jointed.

Pilumnus spino-hirsutus *(Lock.)*

Acanthus spino-hirsutus **LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, pp. 32 and 102.**

Pilumnus spino-hirsutus **STREETS and KINGSLEY, Bull. Essex Inst., Vol. IX, 1877, p. 107. KINGSLEY, Proc. Bost. Soc. Nat. Hist., Vol. XX, 1879, p. 154. A. MILNE-EDWARDS, Crust. in Miss. Sci. au Mex., Pt. V, p. 278. MIERS, Challenger Reports, Vol. XVII, 1886, p. 147.**

Carapace strongly convex, nearly smooth, but covered with stiff setæ. Median frontal lobes truncated, separated by a prominent notch, and armed each with four or five spines; lateral lobes of the front small, separated from the median lobes by a deep notch and ending in a spine. Orbits with the upper, lower and outer margins armed with strong spines of unequal size, the two spines at the intero-inferior angle large and situated on a kind of lobe. Besides the postorbital the antero-lateral margin is armed with three strong spines, and there is a small spine below the margin in front of the first of these. The basal antennal joint barely

reaches the infero-lateral frontal process. Endostome plainly carinated. Pterygostomian regions more or less granulated. Chelipeds unequal, setose; merus scarcely as long as high, the margins finely denticulated; a spine at the supero-distal angle separated from a similar spine behind by a deep notch; outer surface of the carpus thickly covered with spines; upper and outer surface of the hand covered with several series of spines; lower margin finely denticulated; fingers dark colored. Legs setose; carpus and propodus armed above with spines; merus with a spine at the supero-distal angle; dactyls hairy, nearly straight, and subequal to the propodi. Terminal segment of the abdomen in the male triangular.

San Diego, California (Lockington's type)! Mulege Bay, Gulf of California!

APPENDIX TO THE XANTHINI *Ortmann*.

Genus **Telemessus** *White*.

Carapace depressed, subpentagonal, broader than long and covered with setæ. Front wide, the median portion cut into four teeth and separated by a sinus from the lateral portions which form the preorbital teeth. The antero-lateral and postero-lateral margins are dentate and meet each other at an angle. Orbits large; postorbital tooth prominent. Antennules folded longitudinally or nearly so in wide fossettes. Epistome with a triangular point extending forward between the antennules. Basal antennal joint broad, forming a part of the outer wall of the antennulary fossettes and produced on the outer side into a lobe which occupies the inner hiatus of the orbit; flagellum quite long. Maxillipeds produced a little beyond the anterior margin of the buccal area; the merus has a more or less triangular apex and bears the palp on the inner margin just behind the tip. Chelipeds setose and scabrous or spinous and rather short in both sexes; merus trigonous; hands compressed and furnished with spinous or tuberculated ridges on the outer surface. Legs quite long, compressed, scabrous or spinose; dactyls long, compressed, acute. Abdomen of the female seven-jointed, the sides of the sixth joint concave, leaving the genital openings exposed. Abdomen of the male widest at the third segment and having the third, fourth and fifth joints fused.

***Type*.—*T. cheiragonus* (TILESIUS).**

Unless Latreille's bare mention in a list of genera of the name *Cheiragone*[1] without referring to it any species constitutes the genus *Cheiragonus* (or *Cheiragone*), *Telemessus* has priority. According to the A. O. U. code, *Cheiragone* must be considered a "*nomen nudum*."

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[1] Familles nat. a Paris, 1825, p. 270.

Telemessus cheiragonus (*Tilesius*).

Cancer cheiragonus TILESIUS, Mem. Acad. St. Petersbourg, T. V, 1815, p. 347, Pl. VII, fig. 1.

Telemessus serratus WHITE, Ann. Nat. Hist., Vol. XVII, 1846, p. 497; Voyage of Samarang, Crustacea, 1848, p. 14. DANA, Crust. U. S. Expl. Expd., Part I, 1852, p. 303, Pl. XVIII, fig. 8. SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 208.

Platycorystes ambiguus BRANDT, Bull. Phys-math. Acad. St. Petersbourg, T. VII, 1848, p. 179.

Platycorystes cheiragonus BRANDT, Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 85.

Cheiragonus hippocarcinoides BRANDT, Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 147. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 465.

Telemessus serratus and *T. cheiragonus* MIERS, Proc. Zool. Soc. London, 1879, p. 36.

Telemessus cheiragonus BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 224, Pls. XXXV and XXXVI, figs. 2, 3 and 4. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 24. WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 373.

Cheiragonus cheiragonus ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 420.

Carapace depressed, areolated, furnished with granules and thickly covered peculiar clavate setæ. The teeth of the median lobe of the front are triangular, subequal, and extend forward to about the same distance. The preorbital teeth are large and acute and the rounded sinus between them and the median frontal lobe is armed with secondary teeth. Postorbital tooth acute. The margins of the orbit are denticulated and the upper margin is furnished with two small fissures; lower margin entire but deeply concave. Lobe of the basal antennal joint triangular. Merus of the chelipeds spiny; two rows of spines on the upper edge of the hand (the outer row may be reduced to tubercles) and below these four rows of spines or tubercles on the outer surface. Legs furnished with transverse, setose, granulated or, in some cases, spinous lines; dactyls strongly grooved, longer than the propodi. The abdomen of the male is abruptly contracted behind the third segment, a small part of the posterior margin of which projects nearly transversely. The antero-lateral margin of the carapace is furnished with four prominent triangular teeth including the postorbital and the one at the lateral angle; the posterior margins of these teeth are armed with several denticles and the three anterior teeth have each two denticles on the anterior margin; the fourth tooth has three nearly equally spaced denticles on the inner side of its anterior margin and a fourth at a longer interval from the others near the tip. Postero-lateral margin with two teeth. Body and appendages strongly setose.

Length of carapace, 50 mm.; breadth, 64 mm.

Northeastern Siberia, Aleutian Islands, Behring Sea, Sitka, Vancouver's Island, Puget Sound, upper California.

There is a specimen in the museum of the University of California labelled Gulf of California, but possibly this is wrong, as this species appears to be a northern one. This species may be distinguished from *T. acutidens* by its broader carapace, its larger and broader lateral teeth and by the median teeth of the front. For a fuller list of localities and other facts concerning this peculiar species see Benedict l. c., pp. 224–227.

Section PORTUNINEA *Ortmann.*

Carapace more or less rounded, with the antero-lateral margin sharply marked off from the postero-lateral. The last pair of thoracic legs fitted for swimming. Verges of the male in the coxæ.

Genus **Portunus** *Fabr.*

Carapace usually transverse, depressed, and marked with granulated lines. Front short and cut into five to eight teeth. Antero-lateral margins arcuated and armed with nine teeth, all but the last (the largest) being of subequal size. Flagellum occupying the inner orbital hiatus. Merus of the chelipeds armed with spines on the inner margin; hand elongated, prismatic and costate.

Type.—*P. pelagicus* (LINN.).

Portunus Xantusii *(St.)*

Achelous Xantusii STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 222.

Neptunus asper A. MILNE-EDWARDS, Archiv. du Mus. Hist. Nat. Paris, T. X, 1860, p. 325, Pl. XXX, fig. 3.

Neptunus Xantusii A. MILNE-EDWARDS, l. c., 1860, p. 429; Crust. in Miss. Sci. au Mex., Pt. V, p. 213, Pl. XXXVIII, fig. 1, and Pl. XXXIX, fig. 3.

Amphitrite paucispinis LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 107.

Portunus Xantusii RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 593.

Carapace markedly transverse, the upper surface pubescent. Gastric area with a median granulated line and a transverse line, near the middle, which is slightly concave in front; the posterior portion crossed by a short transverse line; a granulated line beginning near the posterior part of the gastric area, at first arching forwards, and then curving backwards near the side of the carapace and extending upon the large lateral spine; two short, oblique, parallel lines on the branchial areas; on the cardiac region there are two short transverse lines situated end to end, their inner extremities curving backwards and meeting to form a longitudinal, median line which is often obscure. Front short and not projecting beyond a line drawn across the tips of the acute triangular projections of the inferior margin of the orbit, the four frontal teeth are equally prominent, the two middle ones slightly narrower than the outer pair and separated from the latter by a slightly wider interval than they are separated from each other. The tooth at the inner angle of the orbit is double pointed. The postorbital tooth is larger than the one behind it and extends nearly as far forward as the teeth of the front. The antero-lateral teeth are sharp and curved forward and show a tendency to alternate in size; the lateral spine is about three times as long as the tooth in front. Upper margin of the orbit with two fissures and a small tooth on the inner side of the outer fissure. A single fissure in the lower orbital margin external to which is a small cusp upon the under side of the postorbital tooth. Chelipeds pubescent, merus armed in front with four to seven spines; posterior margin scabrous but not spiny, with the exception of a small spine at the distal end; carpus with several granulated ridges on the outer surface; a strong spine at the distal end of the upper margin and a smaller spine on the lower side at the distal end of the lowest granulated ridge; hand furnished with a spine at the external hinge joint; the granulated ridge on the upper margin terminates in a spine a little behind the distal end of the palm; four granulated ridges on the outer surface of the hand not counting the upper one; fingers strongly ridged, teeth dark colored; first three pairs of legs slender; merus unarmed. In the male the first and second abdominal segments are free, the third, fourth and fifth coalesced; second and third joints transversely ridged and produced laterally into two acute processes which project beyond the margins of the other segments; sides of the fourth segment strongly convex; last segment narrow and shorter than the preceding one. In the female, the second and third joints are much like those of the male; fourth and fifth transversely ridged, fifth and sixth of subequal length; last joint very small and triangular.

Length of carapace, male	25.25	mm.
Breadth of carapace, male, between tips of lateral spines	53	mm.
Length of cheliped, male	66	mm.
Length of hand male	35	mm.

Another specimen measured 26 mm. by 52 mm.

South America (Milne-Edwards), West Mexico, Panama (Milne-Edwards), Cape St. Lucas (Stimpson), San Diego! Santa Catalina Island! San Pedro!

The specimens of *Amphitrite paucispinis* which were sent by Lockington to Streets and Kingsley were, I believe, wrongly identified with Stimpson's *Achelous panamensis*, instead of with *A. Xantusii* Stimpson, to which species I feel sure they belong[1]. Judging from Stimpson's descriptions, *Xantusii* and *panamensis* are closely allied, the latter species being distinguished by the presence of a spine on the merus of the ambulatory legs. Streets and Kingsley state that Lockington's specimens agreed very well with Stimpson's description of *panamensis, except that the spine on the merus of the ambulatory legs was absent.* I have examined some of Lockington's specimens of *Amphitrite paucispinis*, which are in the possession of the California Academy of Sciences, and they agree perfectly with Stimpson's description of *Achelous Xantusii*, and A. Milne-Edwards' excellent figures of that species in the "Mission Scientifique au

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[1] See Bull. Essex Inst., Vol. IX, p. 107.

Mexique." *Panamensis* apparently does not range so far north as Lower California, while *Xantusii* is common from southern California southward.

Genus **Callinectes** *Stimpson.*

Closely allied to *Portunus*. Carapace broad; front low. Merus of the external maxillipeds prominent and curved outward at the antero-external angle. Abdomen in the male narrow and ⊥-shaped.

Callinectes bellicosus *(Stimpson).*

Lupa bellicosa (SLOAT MS.) STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1859, p. 57.

Callinectes bellicosus ORDWAY, Proc. Bost. Soc. Nat. Hist., Vol. VII, 1863, p. 577. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVIII, 1895, p. 365, Pls. XXII, XXIV. fig. 10; XXV, fig. 8; XXVI, fig. 8; and Vol. XXI, 1898, p. 596.

Lupa bellicosa ? LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 105.

Callinectes bellicosus A. MILNE-EDWARDS, Miss. Sci. au Mex., Pt. V, 1879, p. 227, (var. of *C. diacanthus*).

Carapace broad, convex, minutely granulated. Front with two distant spines, the margin between them sinuous. Preorbital teeth not so advanced as the lateral teeth of the front; postorbital tooth long, exceeding the preorbitals; subfrontal spine exceeding the lateral frontal teeth; a large tooth below the preorbital, which extends further forward than the others. Inner superior orbital fissure open. Teeth behind the postorbital broadly triangular, acute, with concave sides; last tooth about twice the length of the preceding one, its upper edge continued as a fine ridge for some distance on the carapace. Merus of the chelipeds trigonous, armed anteriorly with four or five spines; carpus with two or three external ridges and a few pointed tubercles near the anterior end; hand with a strong spine above the upper hinge joint at the proximal end of a tuberculated costa; ridge on the posterior upper edge ending distally in a spine.

Width 4.5 in.; length 2.5 in.

Gulf of California, west coast of Lower California.

A fine specimen of this species was taken by Miss Cook at Point Loma, California, which is the most northern locality from which it has been recorded.

Subtribe CATOMETOPA, or GRAPSOIDEA.

Carapace wide in front, often subquadrate, sometimes subglobose, and truncated or arcuated anteriorly but not rostrate. The front is usually wide and bent downward. Epistome short, often almost linear. The palp of the maxillipeds may be articulated at the apex or at the inner or outer angle of the merus. Branchiæ generally less than nine; efferent branchial channels as in the Maioidea. Verges in the male in the coxæ, sternum, or in the coxæ of the last pair of legs, thence passing through channel in the sternum beneath the pleon.

This group contains four families, the Gecarcinidæ, Ocypodidæ, Grapsidæ and Pinnotheridæ. The first family, the Gecarcinidæ, includes land crabs and is not represented by any species within our limits, although there are several in Lower California and Mexico.

Family OCYPODIDÆ.

Carapace moderately convex, cancroid or trapezoidal in form, with the antero-lateral margins straight or rounded, and the branchial regions not greatly dilated. Front of moderate width or very narrow. Orbits and eye-stalks of moderate size or greatly developed. Palp of external maxillipeds joined to the antero-internal or rarely the antero-external angle of the merus. Dactyls of the ambulatory legs styliform and devoid of spines. The abdomen usually does not cover the whole width of the sternum between the last pair of legs.

Species mostly small and littoral.

Genus **Uca** *Leach.*

Carapace transverse, widest in front, the antero-lateral angles acute; dorsal surface smooth and granulated. Orbits large, extending to the lateral angles; eye-stalks long and slender. Merus of the maxillipeds generally transverse, smaller than the ischium, distally truncated, and not emarginate at the antero-internal angle; palp joined to the antero-external angle of the merus. Chelipeds in the male very unequal; hand in the larger cheliped very large, fingers longer than the palm. Smaller cheliped (both chelipeds in the female) feeble.

Uca crenulata *(Lock.)*

Gelasimus crenulatus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 149.

Gelasimus vocator KINGSLEY (not HERBST), Proc. Acad. Nat. Sci. Phila., 1880, p. 147.

Gelasimus gracilis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 244.

Uca vocator ORTMANN (not HERBST), Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 352.

Uca gracilis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 603.

Carapace smooth, convex, with the H-shaped impression prominent. Front wide. The lower edge of the superior orbital margin is arched forward more strongly in the middle than the upper one. Lateral margins nearly parallel for a short distance behind the prominent antero-lateral angles of the carapace and then converging. Merus of the maxillipeds much broader than long and much shorter than the ischium. Merus of the large cheliped with the inner margin denticulated and the outer surface crossed by transverse granulated rugæ; carpus with the outer surface granulated and the inner surface crossed by an oblique, usually granulated ridge; hand finely granulated on the outer surface; inner surface with a granulated or tuberculated ridge running from the lower margin to the carpal groove; there is often a line of granulations extending from the upper end of this ridge towards the upper margin of the hand; the carpal groove is deep and covered by the overhanging upper edge of the palm; fingers long and slender; the pollex is nearly straight or bent slightly upwards, and truncated at the tip; dactyl longer than the pollex, curving most strongly near the tip and generally armed with a tooth near the middle of the inner margin. Ambulatory legs pubescent, the merus transversely rugose. Abdomen of the male seven-jointed, the second joint very short.

Todos Santos Bay near San Diego (Lockington); La Paz, Lower California! Guaymas! Sonora, Mexico! San Luis Gonzales Bay! Todos Santos Bay, La Paz, Lower California, San Diego (Miss Rathbun).

The specimens of Miss Rathbun from La Paz and San Luis Gonzales Bay I have seen, and also Mr. Lockington's types. The other specimens examined were in Lockington's collection.

This species is closely allied to *pugnax* Smith, but is distinguished by the more convex carapace, which is much wider behind; by the narrower abdomen in the male with the shorter second segment; by the more slender fingers in the large cheliped, and the more slender merus joints in the ambulatory legs. It may be distinguished from *coloradensis* Rathbun by its darker and more convex carapace, the more slender merus joints in the ambulatory legs, and by the different curvature of the upper side of the palm in the large cheliped. It is a much smaller species than *brevifrons* Stimpson, and has a relatively wider and more convex carapace and very different upper orbital margins.

Uca rectilata *(Lock.)*

Gelasimus rectilatus Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 148.

Gelasimus annulipes Kingsley (not Milne-Edwards), Proc. Acad. Nat. Sci. Phila., 1880, p. 148.

Carapace wide, nearly flat transversely, but longitudinally strongly convex. Front broad and arched strongly forwards. The upper edge of the superior orbital margin is strongly curved; the lower edge runs close to the upper but is distinct; the lower margin of the orbit is prominently denticulated, especially at the rounded outer angle. Postorbital angle prominent, acute, and directed obliquely outwards; the lateral margins of the carapace are straight, converging from the postorbital angles to the straight posterior margin. Maxillipeds with the ischium large, smooth, strongly convex; merus oblique, much wider than long, but narrower than the ischium and about one-third its length. A longitudinal groove on either side of the buccal area. Merus of the larger cheliped but slightly rugose with the angles rounded; carpus lightly granulated on the upper surface; hand similar to that of *crenulata;* the outer surface of the palm finely granulated and the lower edge margined; an oblique, granulated ridge on the inner surface extending from the lower margin to the deep carpal groove; no oblique ridge above this one as in *crenulata;* two parallel lines of granules behind the articulation of the dactyl, the posterior of which is continued upon the pollex; pollex tapering, a tooth near the middle, the extremity slightly excavated; dactyl curved more strongly toward the tip, which slightly overreaches the pollex. Ambulatory legs slender. Abdomen of the male seven-jointed, the first two joints short.

Length of carapace, male	8.75 mm.
Width of carapace, male	13.5 mm.
Length of larger hand, male	19 mm.
Length of carapace, female	7.75 mm.
Width of carapace, female	12.25 mm.

Described from Lockington's types (Cat. No. 3112) in the collection of the California Academy of Sciences.

West coast of Lower California (Lockington).

This species differs from *U. gibbosa* (Smith) in having the surface of the carapace even, with the branchial regions not at all inflated, and in having seven, instead of five, abdominal segments in the male.

U. stenodactyla is reported from San Diego by Ortmann, who unites with this species *gibbosa* (Smith) and *speciosa* Ives[1].

Genus **Speocarcinus** *Stimpson.*

Carapace longitudinally convex both in front and behind, transversely nearly plane; sides converging behind. The space between the outer ends of the orbit exceeds one-half the width of the carapace. Antero-lateral margins dentate. Ocular peduncles of moderate length; eyes small. Orbits and antennæ similar to those of *Panopeus*. Palate devoid of a median elevation. Maxillipeds widely gaping; merus rather short and bearing the palp at the summit. Chelipeds short and stout. Ambulatory legs slender, smooth, with depressed, ciliated dactyls. Genital openings of the male in the sternum.

Abdomen of the male with the base much narrower than the last thoracic sternum; third, fourth and fifth segments coalesced.

Type.—*S. carolinensis* STIMPSON.

Speocarcinus californiensis *(Lock.)*

Eucrate ? californiensis LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 33.

Carapace strongly convex longitudinally, transversely plane, nearly smooth above, but minutely granulated towards the pubescent margins. Median region divided into three areas by pubescent sulci; a longitudinal, pubescent line on the branchial regions which are separated from the

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[1] See Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 356.

hepatic by a transverse sulcus. Front over one-fourth the width of the carapace, the anterior margin straight and emarginate in the center. Upper margin of the orbit nearly straight, not interrupted by fissures; lower margin with an external fissure and a rounded inner lobe. Ocular peduncles slender and about two-thirds as long as the width of the front and furnished anteriorly with two converging rows of long hairs. Antero-lateral margin strongly curved and furnished with three teeth (including the postorbital), the first two of which are thin-edged and lobate, the second one broadly rounded; the last tooth is acute. Buccal area widened in front. External maxillipeds diverging anteriorly, the merus distally truncated, with the antero-external angle rounded and not produced. Chelipeds unequal; merus short, thick, trigonous, with the edges granulated, and furnished with a prominent tooth at the supero-distal angle; carpus with a spine at the antero-internal angle and a short, longitudinal, granulated ridge at the distal end of the outer surface; hands wide, much compressed, the outer surface nearly smooth but granulated near the upper and lower margins; upper edge acute and sharply granulated; fingers ridged, the pollex not deflexed. Legs smooth, glossy, pubescent; dactyls slender with strongly pubescent margins, the last pair and to a less extent the preceding pair upturned. First segment of the abdomen in the male short and wide, but much narrower than the last thoracic sternum; second segment a little longer but markedly narrower than the first; third segment as wide proximally as the first, the sides converging rapidly to the coalesced fourth segment; remaining segments tapering gradually to the rounded extremity.

Length of carapace	16 mm.
Width of carapace	21 mm.

San Pedro, California. Lives in holes on muddy beaches.

Quite closely allied to *carolinensis* St. from the Atlantic coast, but is distinguished by having three instead of five antero-lateral teeth, and by its longer eye-peduncles. From *granulimanus* Rath. it differs in the number of antero-lateral teeth, the smoother hands, and in having the antero-external angle of the merus rounded and not produced.

Family GRAPSIDÆ.

Carapace depressed or moderately convex, more or less quadrilateral, the lateral margins straight or slightly arcuate. Front usually broad, never very narrow. Orbits and eye-stalks of moderate size. Palp of the maxillipeds joined to the summit or antero-external angle of the merus. Chelipeds in the adult male subequal and quite well developed; dactyls of the ambulatory legs styliform, compressed, and armed with strong spines. The base of the abdomen in the male usually covers the whole width of the last thoracic sternum.

The species, with rare exceptions, are littoral or inhabitants of shallow water.

Carapace striated.
  Orbits normal.................................*Pachygrapsus.*
  Orbits bulged outward..........................*Grapsodius.*
Carapace not striated.............................*Brachynotus.*

Genus **Pachygrapsus** *Randall.*

Carapace trapezoidal, depressed, and marked with transverse striæ. Front depressed and over one-half the width of the carapace. Inferior subocular lobe small, not reaching the front, thus allowing the antennæ to enter the orbit. Eye-peduncles short and stout. Maxillipeds devoid of a piliferous ridge and having a wide rhomboidal gap between them; merus as broad as or broader than long, distally truncated and bearing the palp at the summit. Chelipeds subequal, the merus trigonal, with the anterior margin distally dentated. Legs of moderate length, merus dilated and compressed, and furnished with an anterior subterminal tooth or spine; dactyls more or less spinulous. Antero-lateral margins entire or with one or two teeth. Abdomen in the male seven-jointed and covering the whole width of the last thoracic sternum.

Type.—P. crassipes RANDALL.

Pachygrapsus crassipes *Randall.*

Pachygrapsus crassipes RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 127. H. MILNE-EDWARDS, Ann. Sci. Nat. (3), T. XX, 1853, p. 166. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 467. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 153. STREETS, Bull. U. S. Nat. Mus., No. 7, 1877, p. 115. KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1880, p. 199. DE MAN, Notes Leyden Mus., Vol. XII, 1890, p. 86, Tab. V, fig. 11. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 707. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 604.

Carapace nearly square (the sides converging slightly posteriorly), moderately convex, the entire upper surface, except the cardiac and intestinal regions, transversely striated. The front is broad, depressed, slightly arcuated; a single tooth at the outer angle of the front; behind the front are four lobe-like prominences, the two middle ones the more conspicuous, and separated from each other by a groove whose sides are marked with sharp lines. A single tooth on the lateral margin behind the prominent postorbital. The notch at the infero-external angle of the orbit is deep. Orbits deep, the inferior margins strongly granulated. Antennæ minute. Merus of the maxillipeds quite strongly produced at the antero-internal angle; first joint of the palp large and compressed. Merus of the chelipeds short, trigonal, and transversely rugulose, the anterior margin laminate and armed at the distal end with three teeth; carpus finely rugose externally and bearing a tooth or tubercle at the antero-internal angle; hand in the adult male larger than all the preceding joints combined; a raised line usually present on the upper side of the palm and a delicate line on the lower portion of the outer surface. Merus joints of the legs transversely rugulose, strongly compressed and expanded, especially in the last three pairs, the postero-distal angles in the anterior pairs armed with a variable number of teeth; in the last or last two pairs they are rounded and usually edentate; dactyls short, compressed, and spinous on both margins. Third joint of the abdomen in the male strongly convex at the sides; following joints increasing successively in length.

Length of carapace, male	36.5 mm.
Breadth of carapace, male	41 mm.
Length of carapace, female	30 mm.
Breadth of carapace, female	34 mm.

Japan (Stimpson, Ortmann), Sandwich Islands (Randall), Oregon! northern California! San Francisco Bay! Monterey! San Diego! Gulf of California (De Man). A very common species on rocky shores.

This species was originally reported by Randall from the Sandwich Islands, where it has not since been found. On the other hand, *P. parallelus*, which Randall reported as coming from the Columbia River, has not since been found on the west coast of the United States. It is probable, as Stimpson suggests, that the labels of the two species were accidentally exchanged. Several other species reported from this coast by Randall have not since come to light. Possibly mixing of labels has occurred in other cases also.

Genus **Brachynotus** *De Haan.*

Carapace subquadrate, not markedly striated, and having two teeth behind the orbital angle. Front wide, not strongly deflexed. Maxillipeds without a wide rhomboidal gap; ischium transversely truncated; merus large and not produced at the antero-external angle; palp joined in a notch at the middle of the distal margin.

Type.—*B. sexdentatus* (RISSO).

Brachynotus nudus *(Dana).*

Pseudograpsus nudus DANA, Proc. Acad. Nat. Sci. Phila., 1851, p. 249; Crust. U. S. Expl. Expd., Part 1, 1852, p. 335, Pl. XX, fig. 7. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 469.

Heterograpsus nudus STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858 p. 104. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 152. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471. SMITH, Rep. Prog. Geol. Surv. Canada, 1878-9, *B*, p. 206. RATHBUN R., The Fisheries of the U. S., Sec. 1, 1884, p. 765. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 25. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VII, 1894, p. 715. WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 273.

Heterograpsus sanguineus KINGSLEY (not DE HAAN), Proc. Acad. Nat. Sci. Phila., 1880, p. 208.

Carapace posteriorly flat, smooth and punctate, anteriorly convex, undulated, and furnished with small, scattered granules. A curved line of light-colored pits extending from the anterior end of the H-shaped impression to the last antero-lateral tooth. Front bilobed, the median emargination shallow, but comparatively broad. The two transverse prominences behind the front are evenly rounded. Antero-lateral margins strongly arcuated and granulated; the second tooth behind the acute postorbital much smaller than the preceding ones. Posterior margin of the epistome granulated, the arcuated median portion separated from the subquadrate, projecting, lateral portions by a conspicuous, deep, smooth interval. On the pterygostomian regions a ridge running parallel with the antero-lateral margin and armed with numerous smooth, small, rounded denticles or granulations. Maxillipeds punctated; a groove behind the broad, raised, inner margin of the merus. Chelipeds smooth, and mottled above with small, round, red spots; antero-internal angle of the merus in the adult male produced into a rounded, smooth lobe; carpus with a subacute prominence on the inner side; hands smooth, with a fine longitudinal ridge along the lower side of the outer surface; fingers with small, corneous tips. In the males the hands are inflated and bear a large patch of long, fine hair on the inner surface. Legs rather short, smooth, punctate and nude; dactyls short, stout, scabrous; those of the last pair less than two and one-half times (often less than twice) as long as wide, and upturned at the tip.

The color of this species is quite variable. It is generally of a mahogany red, but may be purplish, dark red, or red marbled with white. I have seen some specimens with the upper side almost entirely white. But amid all the variations of color, the red spots on the chelipeds remain, so far as I can determine, an absolutely constant character. Young specimens present greater color variations than older ones.

	Length.	Breadth.
Male	44 mm	51.5 mm.
"	43 mm	50 mm.
"	23 mm	26 mm.
Female	22 mm	25.5 mm.

Sitka (Kingsley); Vancouver's Island (Smith); Puget Sound; common from Oregon to Lower California; Gulf of California (Kingsley). Found among rocks near the shore.

This species differs from *sanguineus* (De Haan), with which it has been united by Kingsley, in having a tuft of hair on the inner side of the hand in the male, and in the different inferior orbital margin.

Brachynotus oregonensis *(Dana).*

Pseudograpsus oregonensis Dana, Proc. Acad. Nat. Sci. Phila., 1851, p. 248; Crust. U. S. Expl. Expd., Part I, 1852, p. 334, Pl. XX, fig. 6. Stimpson, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 468. Milne-Edwards, Ann. Sci. Nat. (3), Zool., T. XX, p. 157. Cooper, Rep. Expl. and Sur. to Pac. Ocean, Vol. XII, 1860, Book 2, p. 389. Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 104. Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1876, p. 152. Kingsley, Proc. Acad. Nat. Sci. Phila., 1880, p. 209. Rathbun, R., The Fisheries of the U. S., 1884, Sec. 1, p. 765.

Carapace more strongly undulated in front than in *nudus* but not so much flattened behind; the posterior portion is not punctate and the anterior portion may be sparsely granulated. Front four-lobed, the median lobes the most prominent. The median portion of the epistome is not granulated nor separated from the lateral portions by a deep smooth interval. The ridge on the pterygostomian region furnished with several smooth, blunt teeth. The prominences behind the front are more conspicuous than in *nudus* and sometimes end abruptly anteriorly. External maxillipeds smooth and punctated; surface of the merus next to the inner margin flat. Chelipeds smooth; carpus with a prominent inner angle; hands with a fine longitudinal ridge on the lower part of the lower surface which becomes very faint with age. In the adult male there is a rounded lobe on the antero-internal of the merus and a patch of long hair on the inner side of the hand. Legs hairy, the dactyls narrower than in *nudus*, those of the last pair upturned.

The color is a dull gray mottled with ferruginous spots. The spots on the legs are small, but there may be blotches of considerable size on the carapace. The color is not so variable as in the preceding species although very young specimens are occasionally marked with large blotches of white.

Length, 23 mm.; breadth, 28 mm.

This species may readily be distinguished from the preceding by its dull color, the hairiness of the legs, the four-lobed front, and the absence of round red spots on the chelipeds so characteristic of that closely related species. *Nudus* is found chiefly among the rocks, while *oregonensis* prefers the mud flats, where it is usually found in abundance.

Vancouver's Island. Common on mud flats from Puget Sound to Lower California. It is also found among rocks near the shore.

Grapsodius, gen. nov.

Carapace striated above, with the sides converging behind, and armed with a single tooth behind the postorbital. Front broad, not deflexed, but with the median portion depressed. Eye-peduncles short. Orbits with the posterior surface bulging outwards instead of concave. Maxillipeds narrow, widely gaping, and devoid of an oblique piliferous ridge; merus subcordate, shorter than the ischium, the antero-internal angle produced; palp joined near the middle of the distal margin of the merus. Dactyls spinulous. Abdomen of the male seven-jointed.

Type.—G. eximius HOLMES.

Grapsodius eximius, sp. nov.

Carapace undulated in front and flattened behind where it is more strongly striated; sides strongly converging posteriorly. The front is over one-half the width of the carapace and has the outer angles more or less projecting and rounded; the anterior edge is thin and minutely granulated; viewed from above it is nearly straight, being slightly convex on either side of the middle where it is a little concave; viewed from in front it sags downward in the center. The orbits are remarkable in being swollen outward so that there is no hollow receptacle, as is usually the case, for the reception of the eyes; the superior orbital margin is marked by a fine ridge extending from the outer side of the front to the postorbital tooth; the inferior orbital margin is marked by a line of granules extending from the lower side of the postorbital tooth to the buccal area. Maxillipeds slender and wide apart. The ischium is much longer than the merus but not so wide; merus with the outer margin convex and the antero-external angle broadly rounded; the inner margin is straight and the antero-internal angle is produced into a prominent narrow lobe; first joint of the palp strongly convex near the middle of the inner margin; exognath at the base about one-half as wide as the ischium and tapering regularly to the tip which reaches slightly beyond the middle of the merus. Chelipeds subequal; merus short, trigonal, the outer surface transversely striated, the inner margin produced into a laminate expansion which is distally truncated and dentate; carpus with a spine near the middle of the upper margin; hands smooth and inflated; the upper margin of the palm is broadly rounded, but bears a fine ridge; a very fine ridge on the lower side of the outer surface extending upon the pollex; fingers subcylindrical, not ridged or grooved, and armed within with small teeth. Merus of the ambulatory legs dilated and compressed much as in *Pachygrapsus crassipes*, with the upper margins acute and ending in a tooth a little behind the supero-distal angle; the infero-distal angle, in all but the last pair, is dentate; carpal joints with a few small spines near the distal end of the upper margin; propodi with the sides strongly convex and the upper and lower margins spiny; dactyls rather narrow, shorter than the propodi, strongly spinose above and below, and terminating in slender claws. The abdomen in the male is widest at the third segment, behind which it tapers to the tip, the sides converging more rapidly towards the posterior end; first segment much longer than the second; third segment about as long as the fourth, the sides strongly convex; fifth segment scarcely longer than the fourth and shorter than the sixth; last segment triangular, acute.

Length of carapace, 18.5 mm.; width of carapace, 21 mm.; width of front, 11.2 mm.

San Diego, California. Collected by A. U. Crawford.

This species is described from a single dried and somewhat imperfect specimen contained in the Museum of the University of California. The form and arrangement of the antennæ and antennules could not be determined, nor could I make out whether or not the inferior orbital lobe was in contact with the front. The front, legs, maxillipeds, and striations on the carapace are similar to those of *Pachygrapsus*, but the character of the orbits separates it from that genus as well as all the other genera of the Grapsidæ.

Family PINNOTHERIDÆ.

Carapace convex or depressed, often more or less membranaceous, the antero-lateral margins entire or very slightly dentate. Front narrow. Orbits and eye-peduncles very small. Buccal area convex anteriorly. The merus and often the ischium of the maxillipeds is well developed, and the palp may be joined to the summit, antero-internal angle, or, rarely, the antero-external angle of the merus. Chelipeds usually small, or of moderate size. Ambulatory legs variable; dactyls generally styliform and not armed with spines.

The members of this family are generally of small size, and most of them inhabit the shells of bivalved molluscs. Some species inhabit the intestine of echinoderms and others the tubes of annelid worms. The Pinnotheridæ are divided by Miers into four subfamilies, only two of which are found in our limits.

Subfamily PINNOTHERINÆ.

Carapace usually convex, subglobose, or transverse. Front not rostrated. Ischium of the maxillipeds rudimentary or absent. The ambulatory legs are all well developed (the last pair is sometimes small); dactyls often short.

Genus **Pinnotheres** *Latr.*

Carapace smooth, subglobose, more or less membranaceous and scarcely wider than long. Orbits small, nearly circular. Front narrow, with the anterior margin nearly straight. Antennules transverse. Maxillipeds oblique, the merus large, usually curved, the last joint of the palp joined to the inner margin of the preceding one. Ambulatory legs subequal and of moderate length.

Pinnotheres nudus *Holmes.*

Pinnotheres nudus HOLMES, Proc. Cal. Acad. Sci., 2d Ser., Vol. IV, 1895, p. 563, figs. 1-5.

Carapace a little broader than long, subquadrate to orbicular in outline, curving downwards towards all the margins; surface smooth and naked. Front rounded, deflexed, not protruding. Orbits ovate. Antennules oblique. Maxillipeds oblique, neatly fitting the buccal area; merus broad, smooth, subquadrate, the outer margin produced into a broadly rounded, laminate expansion; penultimate joint oblong and distally rounded; last joint spatulate, articulated near the base of, and extending somewhat beyond the preceding one. Chelipeds rounded, smooth, devoid of spines or teeth; hands narrow, rather thick; fingers subconical, subequal to the palm. The three anterior pairs of ambulatory legs subequal; dactyls nearly straight; those of the fourth pair longer and more slender than the others.

Length, 20 mm.; breadth, 24 mm.

Santa Cruz (Dr. Anderson's Coll.)! Monterey!

Pinnotheres pugettensis, sp. nov.

Carapace soft, smooth, subpentagonal. Front triangular, acute, curved downwards, scarcely protruding beyond the general coutour of the carapace. Orbits nearly circular. Antennæ shorter than one-half the width of the front. Maxillipeds very oblique, strongly pubescent; merus narrower than in *nudus*, the outer margin convex; penultimate joint broad, subquadrate, distally truncated, last joint minute, joined slightly in advance of the middle of the preceding one but scarcely reaching beyond the tip. Chelipeds smooth; merus short, the upper margin furnished with long hairs; hands narrow, elongated, rounded, smooth, the dactyls and inner side of the palm short, pubescent; fingers subcylindrical, nearly straight, a little shorter than the palm, the tips strongly hooked, dactyl with a low tooth near the base of the inner margin. Ambulatory legs slender, increasing slightly in length posteriorly; propodi hairy above and below; dactyls narrow, compressed, convex above, abruptly contracted near the tip into a short, curved claw; in the three anterior pairs the dactyls are shorter than the propodi and leave the lower margin nearly straight; in the last pair the dactyl is much longer than the propodus, much longer than the preceding dactyls, and has the lower margin concave. The outer surface of the palm is brownish with light-colored reticulations.

Length of carapace, 10 mm.; length of first ambulatory leg, 9.5 mm.
Width of carapace, 10.5 mm.; length of last ambulatory leg, 10.5 mm.

Described from a single female specimen found by Professor W. E. Ritter in the branchial cavity of a species of *Cynthia* from Puget Sound. Collection of the University of California.

Genus **Fabia** *Dana.*

Closely allied to *Pinnotheres*. Carapace smooth, more or less membranaceous, not much broader than long, and marked by a pair of longitudinal sulci which extend backward from the upper margin of the orbits, enclosing between them the median area. Front not rostrated. Eyes normal, not widely separated. Antennulary fossettes not widely separated. Maxillipeds with the merus large and the ischium rudimentary; third joint of the palp articulated on the inner margin of the preceding one. Ambulatory legs subequal and rather slender; dactyls short.

Type.—F. subquadrata DANA.

This genus differs from *Pinnotheres* in no important character except the longitudinal sulci on the carapace.

Fabia subquadrata *Dana.*

Fabia subquadrata DANA, Proc. Acad. Nat. Sci. Phila., 1851, p. 253; Crust. U. S. Expl. Expd., Part I, 1852, p. 382, Pl. XXIV, fig. 5. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 470. LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 155. SMITH, Rep. Prog. Geol. Surv. Canada, 1878-9, *B*, p. 206. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 25.

Carapace smooth, glossy, membranaceous, subquadrate in outline, with the angles broadly rounded; the space between the longitudinal sulci is longer than wide and slightly narrowed behind; antero-lateral margin rounded and marked by a raised line. Front very short and turned abruptly downwards, having no trace of a median or transverse groove. Eye-stalks short, stout, rounded and lodged in nearly circular orbits. Antennules obliquely plicated in very wide fossettes. Antennæ minute. Maxillipeds very oblique; merus large, smooth, curved and distally rounded; the penultimate joint of the palp is broad, flattened, and bears the minute third joint near the middle of the inner margin. Chelipeds smooth and rather slender; hand long and narrow; palm about twice as long as wide, with the upper and lower margins parallel, and having one or two rows of hairs below, one of which reaches to the tip of the finger; fingers longitudinal, subcylindrical, nearly straight, and shorter than the palm; dactyl with a tooth a little behind the middle of the inner margin. Legs slender, glossy, and nearly naked, but the upper side of the merus and the lower side of the propodus are generally more or less pubescent; dactyls pubescent, about half the length of the propodi, and subuncinate at the tip. Color in life, whitish; carapace and abdomen largely covered with orange.

Length of carapace, female, 11.5 mm.; width, 13 mm.

The following measurements are given by Dana from his specimen from Puget Sound: Length of carapace, 5.75 lines; breadth, 6.75 lines; breadth between post-frontal sutures, 2.25 lines; length of third joint of fourth pair of legs, 2.75 lines, or about two-fifths the breadth of the carapace.

Queen Charlotte Is. (Smith), Puget Sound (Dana), Farallon Is. and San Diego (Lockington), San Pedro! in shell of *Tapes*. It is found also in the shell of *Pachydesma crassitelloides* and sometimes in the tests of *Echini*.

Genus **Pinnixa** *White* (emended).

Carapace much wider than long. Front narrow, nearly transverse. Orbits broadly ovate or nearly circular, with a wide inner hiatus which is partly occupied by the basal antennal joints. Antennules transversely or obliquely plicated in wide fossettes which communicate with each other beneath the front. Eye-stalks very short. Epistome linear-transverse. Ischium of the maxillipeds small; merus large, the distal portion of the outer margin convex; palp joined to the summit of the merus, the third joint joined on the inner side of the preceding one near the base. Chelipeds of moderate size; merus trigonous; carpus smooth; hand large, compressed. Second ambulatory legs larger than the first; the third pair is the largest of all; fourth pair much shorter than the third and relatively stouter than the first and second. The abdomen in both sexes is seven-jointed and narrower at the base than the width of the last thoracic sternum.

Type.—P. cylindrica SAY.

Pinnixa occidentalis *Rath.*

Pinnixa occidentalis RATHBUN, Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 248. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 26.

Male: Carapace uneven, about twice as wide as long; median region tumid and bounded by sulci on either side and behind; a transverse crest on the cardiac region which is not interrupted in the middle but becomes lower and curves backwards. Behind this crest, which is more prominent in the male, the carapace slopes rapidly downward, being nearly at right angles to the surface in front of it. Front narrow, depressed, furnished with a median groove, and not projecting beyond the general contour of the carapace; a pair of prominences behind the anterior margin which is slightly produced at the center. The antero-lateral margin is marked by a sharp, more or less granulated line which begins a short distance external to the orbit and meets the postero-lateral margin at a little less than a right angle. Antennæ longer than the width of the front. Maxillipeds nearly longitudinal; second joint of the palp narrow (over twice as long as wide), and tapering slightly from the base to the rounded tip; last joint narrowly spatulate (about four times as long as broad), joined near the base of and extending much beyond the preceding one; outer surface of the last two joints sulcated. Chelipeds stout; hand broad, smooth and shining, slightly widened distally, the upper and lower margins rounded and scabrous; pollex broad, short, deflexed and furnished with one or more teeth on the inner margin; dactyl much curved, sometimes having a minute tooth near the middle of the inner margin. The first pair of ambulatory legs is slender, having slender dactyls which are subequal to the preceding joint; second pair similar to the first but longer and stouter; third pair longer and much stouter than the second, but more slender than in *tubicola* or *littoralis;* the dactyls slender, almost straight, and about equal to the propodi; fifth pair stouter than the first and nearly as long, reaching considerably beyond the merus of the preceding pair; dactyls slender, straight, and about equaling the propodi. The abdomen tapers gradually from the second segment to the last, which is rounded; the third, fourth, and fifth segments are subequal and slightly longer than the sixth. The appendages and sides of the carapace are more or less pubescent. The upper and lower margins and, to a less extent, the surfaces of the ambulatory legs, are scabrous.

	Length of Carapace.	Breadth of Carapace.	Length of Third Ambulatory Leg.
Male	7 mm	13.75 mm	19 mm.
"	9.5 mm	19.5 mm	27 mm.
Female	5 mm	9.25 mm	13.5 mm.
"	10.5 mm	20.5 mm	24 mm.

Described from specimens received from Miss Rathbun.

Alaska to Washington, San Diego (Rathbun); British Columbia (Newcombe).

In the female the carapace is more tumid and the chelipeds smaller. One small female which I collected on the coast of Humboldt County, Calif., had the carapace entirely covered with a short pubescence.

Pinnixa californiensis *Rath.*

Pinnixa californiensis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 249; and Vol. XXI, 1898, p. 605.

This species is very closely allied to *occidentalis*, but the carapace is relatively wider and more flattened above, the cardiac ridge does not curve backwards so strongly in the middle, the antero-lateral ridge is straighter, and curves backward more abruptly toward the outer end, the median region is less tumid, and the carapace descends more abruptly at the sides. The second abdominal segments in the males of the two species that I have do not present any appreciable differences, although in the specimens described by Miss Rathbun the sides of that segment were parallel in *californiensis* and divergent posteriorly in *occidentalis*. The ambulatory legs are almost exactly alike in the two species and differ much from those of the other *Pinnixas* on our coast.

	Length of Carapace.	Breadth of Carapace.	Length of Third Ambulatory Leg.
Male	4.75 mm	10 mm	13 mm.
Female	4.5 mm	9.75 mm	12 mm.

Described from specimens received from Miss Rathbun.

Monterey Bay and off Point Ano Nuevo, California; Magdalena Bay, Lower California (Rathbun). The locality of the specimens described is lat. 36° 47′ 50″ N.; lon. 121° 49″ W.; depth, 37 fathoms.

Pinnixa tubicola *Holmes.*

Pinnixa tubicola HOLMES, Proc. Cal. Acad. Sci., 2d Ser., Vol. IV, 1895, p. 569, Pl. XX, figs. 17 and 18.

General form subcylindrical. Carapace about two and one-half times as long as wide, strongly curved downward towards the anterior margin and at the sides. A shallow, transverse depression behind the gastric area, behind which is a convex (not crested) transverse intumescence, from which the carapace curves sharply downwards towards the broad, slightly concave posterior margin. Front short, deflexed, not projecting beyond the general contour of the carapace. Outer portion of the anterolateral margins defined by a ridge. The last joint of the palp of the maxillipeds is spatulate and joined near the base of, and extending considerably beyond the preceding one. Chelipeds rather small; hand oblong, longer than the preceding joints combined; fingers hooked at the tips, their inner margins meeting when closed. First pair of ambulatory legs slender, with slender dactyls which about equal the length of the propodi; second pair much longer and stouter than the first, the dactyls relatively stouter than in the first pair and a little shorter than the propodi; third pair stouter and a little longer than the second and furnished with shorter and stouter dactyls, which are markedly shorter than the propodi; fourth pair similar to but much shorter than the third.

Length of carapace, 4 mm.; width, 10 mm.

Puget Sound! Trinidad! Cape Mendocino! Bodega Bay! San Pedro! San Diego!

Pinnixa littoralis *Holmes.*

Pinnixa littoralis HOLMES, Proc. Cal. Acad. Sci., 2d Ser., Vol. IV, 1895, p. 571, Pl. XX, figs. 14-16.

Carapace naked, flattened above; a transverse depression behind the median region followed by a transverse intumescence. The front is not strongly depressed and projects beyond the general outline of the carapace; it is anteriorly truncated and furnished with a median groove. Maxillipeds similar to those of *tubicola;* the terminal joint extends only a short distance beyond the preceding one. Chelipeds large, smooth; hand large, compressed, oblong, but widening slightly distally; pollex short, directed obliquely downwards and furnished at the tip with a notch, into which the point of the dactyl closes; dactyl curved, and when closed against the pollex, a large rounded space is left between them. Ambulatory legs almost entirely naked, more slender than in *tubicola,* first pair but little shorter than the second, which is but little shorter than the third; the dactyls in all the legs are little, if any, more than one-half the length of the propodi and are curved at their corneous tips. Abdomen of the male tapering evenly from the base to the tip; the sides of the penultimate joint are concave, those of the remaining joints straight.

Length of carapace, 4.5 mm.; breadth, 9.5 mm.; length of third ambulatory leg, 11 mm.

Bodega Bay! near Fort Bragg, California!

Pinnixa longipes *(Lock.)*.

Tubicola longipes LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 55. *Pinnixa longipes* LOCKINGTON, *Ibid.*, Vol. VII, 1877, p. 156. STREETS and KINGSLEY, Bull. Essex Inst., Vol. IX, 1877, p. 107. HOLMES, Proc. Cal. Acad. Sci., 2d Ser., Vol. IV, 1895, p. 573, Pl. XX, figs. 19 and 20.

Carapace considerably more than twice as wide as long, somewhat flattened above and furnished with a transverse depression behind the gastric area. Front slightly projecting, furnished with a median groove and a transverse groove behind the anterior margin. The last joint of the palp of the maxillipeds is spatulate and joined near the base of, and slightly exceeding the preceding joint. Chelipeds small, short, hairy; hands oblong, compressed. First two pairs of ambulatory legs slender (the second somewhat larger than the first), and furnished with slender, nearly straight dactyls which are about equal in length to the propodi; following pair of legs enormously developed; merus with a kind of flange on the posterior margin; dactyl stout, curved, much shorter than the propodus; last pair small and stout, scarcely reaching beyond the middle of the merus of the preceding pair; dactyl stout, curved, shorter than the propodus.

Tomales Bay (Lockington)! San Pedro, Calif.!

This species lives in the tube of an annelid worm *(Clymenella)*. It forms the extreme point of modification of this peculiar genus. There is probably no other crab which has such great width relatively to its length, there is certainly no known species in which the fourth pair of pereopods is so enormously enlarged; and I believe there is no Brachyuran which exceeds it in smallness of size.

Pinnixa faba *Dana.*

Pinnitheres faba DANA, Proc. Acad. Nat. Sci. Phila., 1851, p. 248; Crust. U. S. Expl. Expd., Part I, 1852, p. 381, Pl. XXIV, fig. 4. BATE, in Lord's Nat. in Vancouver's Island, Vol. II, 1866, p. 271.

Pinnixa faba STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 470. COOPER, Rep. Expl. and Surv. Pac. Ocean, Vol. XII, Book 2, 1860, p. 387. HASWELL, Cat. Australian Crust., p. 113. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 25.

Carapace strongly convex, both longitudinally and transversely; no transverse ridge behind the gastric area. Antero-lateral margins marked by a low ridge which disappears near the orbits. Front slightly projecting and divided into two rounded lobes. Antennules transversely plicated. Antennæ much longer than the width of the front. The penultimate joint of the palp of the maxillipeds projects considerably beyond the terminal one; both joints are more or less sulcate on the outer surface. Hands of the chelipeds flattened, widest just behind the articulation of the dactyl, and more or less pubescent on the inner side between the fingers; fingers gaping at the base; dactyl curved, acute and furnished with a tooth near the middle of the inner margin; and (generally) a row of hairs on the upper edge; pollex short, nearly straight, and obliquely truncated at the tip. First pair of ambulatory legs shorter than the second; dactyls subconical from a stout base and slightly curved; third pair longer and stouter than the second, the dactyl similar in form though stouter; last pair larger than in most of the species, the propodus reaching beyond the merus of the preceding pair; dactyls more slender than those of the third pair. Upper and lower edges of the ambulatory legs (generally) quite strongly pubescent. Abdomen of the male tapering evenly to the penultimate joint, which tapers more rapidly than the preceding ones; last joint about as long as wide and rounded at the tip.

Vancouver's Island (Smith); Queen Charlotte Island (Newcombe); Puget Sound (Dana); Shoalwater Bay (Cooper); San Pedro, Calif.!

Dr. H. P. Johnson found several specimens of this species in the cloaca of a large species of Holothurian, *Liosoma arenata* St. It more commonly occurs in the shells of large bivalved molluscs.

Pinnixa (Scleroplax) granulata *(Rath.).*

Scleroplax granulatus RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 251.

Carapace strongly convex, curving downward towards all the margins; sides rounded. Front very narrow (not one-fifth the width of the carapace), somewhat produced, almost transverse (slightly convex in the center), and uniformly convex above, having no median or transverse groove. No prominences behind the front. Median region not marked by sulci. Surface of the carapace more or less granulated anteriorly and near the margins, elsewhere smooth and punctate. Antero-lateral margin defined by a finely granulated ridge which runs parallel to the inferior margin of the carapace until very near the point, where it disappears, when it bends toward the lower margin but is not continued far enough to meet it. Orbits nearly circular. Antennules nearly transverse. Maxillipeds nearly longitudinal; merus broad, not curved; second joint of the palp narrow and longer than the merus, tapering gradually to its rounded tip; third joint rather narrow, spatulate, joined near the base of, and slightly exceeding the preceding joint; both of the last joints are grooved on the outer surface and fringed with long hair. Chelipeds of the female small, granulated, shorter than the following legs; hands pubescent, of moderate size, margins rounded; palm more or less inflated; pollex nearly longitudinal; dactyl curved. Ambulatory legs slender, compressed, not markedly unequal; dactyls very long, slender, almost straight, about equaling the propodi in all the pairs, and furnished with long, sharp, corneous tips; the first pair is somewhat smaller than the second, which is smaller than the third pair. Abdomen of the female smooth and shining.

Length of carapace, female, 7.75 mm.; breadth, 10.75 mm.; length of third ambulatory leg, 11 mm.

Ensenada, Lower California (Miss Rathbun); Bodega Bay, Calif.!

The genus *Scleroplax* cannot be sustained, I believe, as some undoubted *Pinnixas* have a hard carapace and there are transition forms between *granulata*, in which the third pair of ambulatory legs is but little larger than the others, and the species in which the third pair is greatly developed. There are similar gradations between the very wide forms like *longipes* and the narrower species like *granulata* and *faba.*

Genus **Parapinnixa** *Holmes.*

Carapace much broader than long, the anterior margin nearly straight. Frontal process deflexed. Orbits nearly round. Antennules transversely or obliquely plicated, the fossettes communicating with each other beneath the front. Buccal area small, subtriangular. Maxillipeds with the ischium rudimentary, the merus large, triangular; palp two- or three-jointed, the last joint joined to the tip of the preceding one. First pair of ambulatory legs the largest, the others diminishing successively in length, the last pair being quite small. Abdomen of female small, not nearly covering the sternal area.

Type.—P. nitida (LOCK.)

Parapinnixa affinis, sp. nov.

Closely allied to *P. nitida*, but the carapace is less than twice as wide as long, while in that species the width of the carapace is over twice its length; the surface of the carapace is smooth and shining and the anterior margin straight. Front triangular, depressed, having a short median groove. Antennules oblique. Buccal area small, triangular, rounded in front, the posterior portion partly covered by a projection of the sternum. Chelipeds stout, smooth; hand thickened, smooth, rounded above and below; dactyl hooked at the tip and armed with a small tooth near the middle of the inner margin, the upper side smooth; pollex with two teeth at the tip. First pair of ambulatory legs larger than the others; dactyls short and stout. Next two pairs comparatively slender, having longer dactyls; last pair small, reaching about to the tip of the merus of the preceding pair; dactyls short and stout. Abdomen of the female widest at the third segment, behind which its shape is triangular, the tip broadly rounded.

Described from a single female specimen collected at Dead Man's Island, San Pedro, Calif., by Mr. F. W. Bancroft, July, 1895. Collection of the University of California.

The maxillipeds in this species are similar to those of *nitida*. They were accidentally lost after I had removed them from the specimen; the palp appeared to have but two joints, but the examination was not made with sufficient care to make me feel sure of this point.

Genus **Cryptophrys** *Rathbun.*

Carapace subpentagonal, hard, convex, not much broader than long. Front produced. Orbits nearly circular and lodged in the sides of the front, only a small part of them visible from above. Antennules oblique or transverse. Buccal area much curved. Maxillipeds very oblique, the distal extremities (not as is usual the inner margins) being opposite each other and separated by a space in which the palpi are lodged; ischium rudimentary; merus large and curved; palp two-jointed and joined to the antero-external angle of the merus. Chelipeds moderately stout, the palm in the male broad and inflated. Ambulatory legs compressed; first three pairs subequal; fourth pair shortest. The base of the abdomen in the male does not cover the whole of the last thoracic sternum.

Type.—*C. concharum* Rathbun.

Cryptophrys concharum *Rath.*

Cryptophrys concharum Rathbun M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 250.

Carapace smooth, slightly longer than broad; a faint sulcus behind the gastric region but no longitudinal sulci as in *pubescens*. Front emarginate. Antennules large, nearly transverse. Ocular peduncles short, stout, and completely filling the orbits. Antero-lateral margins marked by a ciliated line. Sides of the carapace broadly rounded. Merus of the maxillipeds with the outer margin curved, the distal portion almost transverse; the last joint of the palp four-sided, the extremity widened. Chelipeds and ambulatory legs margined by a row of coarse hairs. Ambulatory legs widened and quite strongly compressed; second pair a little longer than the others; fourth pair overreaching the carpus of the preceding pairs; dactyls short, terminating in slender, curved, corneous tips. Abdomen in the male widest at the second joint; the large, compound segment has the margin at first convex and then slightly concave; the two following segments broader than long; terminal segment subrectangular but distally rounded; the last two segments may be partly coalesced.

Length, 4.7 mm.; breadth, 4.2 mm.

False Bay, San Diego County, Calif., from the mantle of *Mya arenaria* L. and Puget Sound from the mantle of *Cardita borealis* Conrad (Miss Rathbun). San Diego!

Described from specimens from Puget Sound kindly sent me by Miss Rathbun. A specimen I collected at San Diego was found on the beach free from any host.

Subfamily ASTHENOGNATHINÆ.

External maxillipeds with both ischium and merus well developed. Last pair of ambulatory legs not rudimentary or abortive.

Genus **Opisthopus** *Rathbun.*

"Carapace usually firm and unyielding; smooth, subquadrilateral, regions not defined; lateral margins regularly arcuated. Epistome very short. Abdomen seven-jointed, in the male not covering the sternum between the coxæ of the last pair of ambulatory legs. Eye-peduncles short. Antennæ small, situated at the inner orbital hiatus; basal joint small. Antennulæ obliquely plicated. External maxillipeds with the ischium well developed, the merus broad, the palpus three-jointed, the ultimate joint articulated on the inner side of the penultimate. Chelipeds moderate; ambulatory legs subequal in length, joints flattened."

Type.—O. transversus RATHBUN.

Opisthopus transversus *Rath.*

Opisthopus transversus RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 252.

Carapace thin, convex, transverse. Front deflexed, with a slight median sulcus. Ischium of the maxillipeds broad; merus as broad as long, with the antero-external angle broadly rounded; palp large, last joint "narrow, inversely spatulate, overreaching the penultimate joint. Chelipeds rather stout; merus broad, trihedral; palm a little longer than the fingers, thick, slightly compressed, margins rounded, lower margin convex." Ambulatory legs similar; second pair longest; fourth pair shortest; dactyls small, curved, little more than half the length of the propodi.

	Length of Carapace.	Width of Carapace.
Male	8.5 mm	9.8 mm.
Female	11 mm	13 mm.
"	14 mm	18 mm.

Monterey and Point Loma (Miss Rathbun). One male from the shell of *Lucapina crenulata* Sowerby from Monterey. San Diego!

Subtribe OXYSTOMATA, or LEUCOSOIDEA.

Carapace very variable in form. Epistome rudimentary. Buccal area narrowed in front. Antennules longitudinal or oblique. The afferent branchial channels enter either behind the pterygostomian regions and in front of the chelipeds, or at the antero-lateral angles of the palate. Verges of the male in the sternum or the coxæ.

Family CALAPPIDÆ.

Afferent branchial channels opening behind the pterygostomian regions and in front of the chelipeds. The palp of the external maxillipeds is not entirely concealed by the merus. Verges of the male on the coxæ of the last pair of legs.

Genus **Platymera** *Milne-Edwards.*

Carapace convex, transversely elliptical, with a strong spine at the lateral angles; antero-lateral margins arcuated and dentate; postero-lateral margins not produced into lateral expansions. Front narrow. Orbits oval, deep, of moderate size, and furnished with a prominent fissure in the lower margin. The basal antennal joint is situated in the wide inner orbital hiatus and does not reach the front; flagellum small. Buccal cavity comparatively in front and more or less completely divided by a median ridge. The external maxillipeds do not completely cover the anterior portion of the buccal area; merus subequal to the ischium and excavated at the antero-internal angle; palp situated at the antero-internal angle of the merus and not completely covered over; the epipodite forms a broad, semilunar plate which covers the opening of the afferent branchial channels. Chelipeds large and, when folded, fitting closely to the body; merus trigonal; hands large, compressed, distally widened, surmounted by a laminate and dentate crest, and furnished with a longitudinal, granulated ridge near the lower side of the outer surface. Ambulatory legs slender, compressed, and furnished with long, styliform dactyls; first three pairs subequal in length, the fourth the shortest. Sternal plastron oval. The abdomen in the male is composed of five distinct joints, the third of which is furnished with a prominent, transverse posterior crest.

Type.—*P. Gaudichaudii* Milne-Edwards.

Platymera Gaudichaudii *Milne-Edwards.*

Platymera Gaudichaudii MILNE-EDWARDS, Hist. Nat. Crust., T. II, 1837, p. 108. EDWARDS and LUCAS, D'Orbigny's Voy. l'Amer. Mérid. VI, Part I, 1843, p. 28, Pl. XIII, fig. 1. FAXON, Mem. Mus. Comp. Zool. Harvard Coll., Vol. XVIII, 1895, p. 32. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 610.

Platymera californiensis RATHBUN M., Proc. U. S. Nat. Mus., Vol. XVI, 1893, p. 253.

Carapace strongly convex, evenly granulated and furnished with several small, depressed tubercles. The anterior margin of the front is truncated and strongly concave when seen from in front. Postorbital tooth very small. Antero-lateral margin regularly arcuated and armed with about fifteen small teeth separated by concave interspaces. Lateral spine large, straight, subcylindrical. Maxillipeds granulated; ischium dentated on the inner margin; merus very deeply excavated at the antero-internal angle. Merus of the chelipeds armed with a spine at the infero-distal angle, above which is a small tooth; carpus with some small tubercles on the outer surface; hands also furnished with several small tubercles on the outer surface; the ridge on the lower portion of the outer surface is very large and bears a small tooth near the proximal end; the superior crest is more or less hairy and armed with six teeth; a granulated ridge on the lower side of the hand; pollex short, subtriangular, flattened, depressed; the outer margin of the finger is prominent, granulated, and when closed, is at right angles to the palm. Upper margins of the ambulatory legs granulated, either the first or the second pair may be the longer.

Length of carapace, 41 mm.; breadth between tips of lateral spines, 79 mm.; length of lateral spine, 12 mm.

Described from a specimen received from Miss Rathbun.

Chili; Panama to lat. 37° 0′ 30″ N., lon. 122° 33′ 30″ W. Depth, 29 to 204 fathoms.

Family LEUCOSIIDÆ.

Afferent branchial channels opening at the antero-lateral angles of the palate. Palp of the external maxillipeds entirely concealed beneath the merus. Verges of the male on the sternum.

Genus **Randallia** *Stimpson.*

Carapace subhemispherical, evenly rounded at the sides, with two lobes or teeth on the posterior margin. Front narrow, very short, with a concave anterior margin. Eyes small, and located in small, circular orbits which are provided with two or three marginal fissures. Antennules obliquely plicated, the laminiform basal joint capable of closing over and concealing the following joints. Antennæ minute, with the basal joint comparatively large. Merus of the maxillipeds subtriangular, shorter than the ischium, reaching nearly as far forward as the front; exognath broad and nearly as long as the endognath. Chelipeds rather long; merus subcylindrical; hand narrow; fingers acute and somewhat compressed. Ambulatory legs of moderate length, the joints not dilated; dactyls styliform. The base of the abdomen in the male covers the last thoracic sternum; distal portion narrowed.

Type.—*R. ornata* (RANDALL).

Randallia ornata *(Randall).*

Ilia ornata RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 129.
Guiaia ornata GIBBES, Proc. Am. Ass. Adv. Sci., 1850, p. 186.
Randallia ornata STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 85; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 471, Pl. XIX, fig. 3; Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 69. RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 613.

Carapace nearly smooth, but furnished anteriorly with a few scattered granules and a few larger granulations at the sides. A granulated intumescence on the hepatic area and a blunt, granulated projection on the pterygostomian regions. A small tubercle on the posterior portion of the branchial region. Posterior margin of the carapace elevated, granulated, and furnished with two pointed tubercles. Maxillipeds granulated, the exognath considerably narrower than the endognath. Merus of the chelipeds subcylindrical, pustulate; carpus granulated; hand long, palm inflated, and granulated on the upper margin; fingers slender, sulcate, generally longer than the palm, and finely dentate. Ambulatory legs subcylindrical; propodi with acute, granulated upper margins; dactyls longer than the propodi; those of the first pairs compressed; those of the last depressed. Abdomen of the male narrowly triangular, acute, five-jointed, the third joint longer than the two following ones. Penultimate abdominal segment in the female large, smooth, convex, covering nearly the entire sternum; last joint small, oblong, distally rounded. The sternal surface in the female is deeply excavated and bounded by a prominent rim, against which the large segment of the abdomen closes. The inner side of this segment is hollowed out, thus forming a capacious chamber for holding the ova. At the anterior margin of the rim is a deeply concave notch which receives the small, terminal segment of the abdomen.

The carapace is of a light color marbled with reddish patches which are larger in front.

Length and breadth of a specimen each 48 mm.

Mendocino County, Calif.! Santa Barbara! Santa Catalina Island! San Diego! Magdalena Bay and off Abreojos Point, Lower California (Rathbun).

Randallia bulligera *Rathbun.*

Randallia bulligera RATHBUN M., Proc. U. S. Nat. Mus., Vol. XXI, 1898, p. 614, Pl. XLIV, fig. 6.

A small species. Carapace a little longer than wide and covered with distinct, smooth, bead-like tubercles; a sulcus behind the tumid hepatic regions, and in front and at the sides of the intestinal area; posterior margin of the carapace with two, pointed, granulated tubercles; a granulated tubercle on the posterior end of the branchial area, and a single tubercle on the intestinal region; frontal margin concave. Pterygostomian regions with a longitudinal, tuberculated prominence. Antero-lateral angles of the buccal area with three prominent lobes which project in front of the maxillipeds. Sternum and abdomen tuberculated. Maxillipeds with prominent tubercles. Merus of the chelipeds cylindrical, tuberculated like the carapace; carpus and hand granulated. Ambulatory legs granulated; dactyls slender, longer than the propodi.

Coloration much as in *ornata*.

Magdalena Bay, Lower California (Miss Rathbun); off San Diego, 30 fathoms!

Easily distinguished from *ornata* by the numerous bead-like tubercles on the carapace and the lobes at the anterior end of the buccal area.

Tribe MACROURA.

Body generally elongated, though sometimes broad. Abdomen generally large and exceeding the carapace in length, the sixth segment usually bearing well developed pleopods which, with the telson, form a strong tail-fin. Eye-peduncles not lodged in well defined orbits. Antennules generally elongated and not lodged in fossettes. Antennæ usually furnished with a scale (exopod) attached to the second joint. The external maxillipeds are typically pediform. Any or none of the pereopods may be chelate. The vulvæ of the female are in the coxæ of the third pair of legs.

KEY TO THE SUBDIVISIONS OF THE MACROURA.

- Abdomen asymmetrical.......................................*Paguridea.*
- Abdomen symmetrical.
  - Exoskeleton calcareous; pereopods mostly six-jointed.
    - None of the three anterior pairs of pereopods chelate....*Loricata.*
    - All of the three anterior pairs of pereopods chelate...*Homaridea.*
    - First pair, or first two pairs of pereopods chelate; third pair never chelate.
      - Last pair of pereopods reduced, slender, folded.
        - Thoracic sternum broad......................*Galatheidea.*
        - Thoracic sternum linear.......................*Hippidea.*
      - Last pair of pereopods not greatly reduced.....*Thalassinidea.*
  - Exoskeleton generally corneous; pereopods seven-jointed.
  - Antennal scale large. Swimming forms with generally laterally compressed bodies.
    - Third pair of pereopods chelate......................*Penæidea.*
    - Third pair of pereopods not chelate...................*Caridea.*

Subtribe HIPPIDEA.

Carapace ovate or subquadrate, comparatively smooth, the regions not well defined. Interantennulary region broad. Eyes small. Antennules generally well developed, with one flagellum elongate, the other short or absent. Antennæ with a large five-jointed peduncle, with or without an acicle. Maxillipeds more or less operculiform. Dactyls of the ambulatory legs flattened; fifth pair of legs slender and filiform. Thoracic sternum linear. Abdomen partially extended; telson large; penultimate abdominal joint with a pair of biramous lamellate appendages, which, however, do not form a caudal fin in connection with the telson. The males have no abdominal appendages, except the last pair. Pterygostomian regions free from the epistome.

Family HIPPIDÆ.

Antennal acicle small or absent. Maxillipeds operculiform, the merus broad; exognath wanting. First pair of legs not subchelate. Telson elongated, lanceolate.

Genus **Hippa** *Fabr.*

Antennules of moderate length. Antennal flagellum very long, stout, multiarticulate and strongly ciliated. Maxillipeds with the ischium very small and the merus very large; the terminal joint narrow and compressed. Dactyls of the first pair of legs oval and lamellate.

Type.—H. emerita L.

Hippa analoga *St.*

Hippa emerita DE SAUSSURE, Rev. et Mag. de Zool., T. V, 1853, p. 367. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. IX, 1896, p. 232.

Hippa talpoidea DANA., Proc. Acad. Nat. Sci. Phila., 1854, p. 175.

Hippa analoga STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 85; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 486. MIERS, Journ. Linn. Soc. London, (Zool.) Vol. XIV, 1879, p. 324, Pl. V, fig. 10. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VI, 1892, p. 537, Pl. XXVI, fig. 1.

Carapace oblong-oval, very convex, and marked with irregular, transverse, crenulated lines which become much less marked towards the sides and posterior end. An impressed, nearly straight, transverse line behind the front, and an impressed line which is concave in front on the median region. Median lobe of the front subtriangular but rounded at the tip; the lateral lobes are triangular and acute and project farther forward than the median lobe from which they are separated by round, smooth sinuses. Antero-lateral margins serrated. Eye-stalks long and very slender. Second joint of the antennal peduncle furnished with three spines of which the median is the largest and upturned at the tip; lowest spine smallest; superior spine more or less upturned; flagellum very long, curved and bent back under the body. Merus of the maxillipeds with the lobe at the antero-internal angle rounded. First pair of thoracic legs with a strong spine at the supero-distal angle of the carpus and at the infero-distal angle of the propodus; dactyl ovate. Dactyls of the second and third pairs falcate, very broad at the base, and subacute at the tip. Telson narrowly triangular, acute; outer surface convex, smooth, glossy; margins raised and furnished with two rows of hairs, the inner row lying on the surface.

Length of carapace, 29 mm.; width, 23 mm.; length of telson, 19 mm.; width of telson, 9.5 mm.; length of abdomen when extended, 37 mm. The ratio of the length of the carapace to its breadth is quite variable.

Oregon to Panama on sandy beaches.

Family ALBUNEIDÆ.

Anterior legs more or less perfectly chelate. The maxillipeds are subpediform or only moderately expanded, and furnished with an exognath. Telson not elongated, generally ovate and lamellate.

Genus **Blepharipoda** *Randall.*

Eye-peduncles very slender, elongated, cylindrical, and articulated in the middle. Antennules and antennæ rather long, with multiarticulate flagella. Antennæ devoid of an acicle. Merus of the maxillipeds narrow, similar to the carpus; carpus not produced at its antero-external angle.

Type.—*B. occidentalis* RANDALL.

Blepharipoda occidentalis *Randall.*

Blepharipoda occidentalis Randall, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 131, Pl. VI. Gibbes, Proc. Am. Ass. Adv. Sci., 1850, p. 187. Dana, Crust. U. S. Expl. Expd., Part I, 1852, p. 406. Stimpson, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 486; Proc. Acad. Nat. Sci. Phila., 1858, p. 230. Miers, Journ. Linn. Soc. London, Vol. XIV, 1879, p. 334. Ortmann, Zool. Jahrb. Abth. f. Syst., Bd. IX, 1896, p. 222.

Carapace oblong, scabrous in front, but smooth and punctate behind. The middle of the carapace is elevated, forming a longitudinal ridge which ends anteriorly in a spine immediately behind the transverse postfrontal impression. A transverse impression behind the median region and an oblique one on either side terminating at the last lateral spine. Front with a median spine separated by a rounded sinus from the more prominent triangular spine-tipped, lateral teeth. Antero-lateral margin with three large spines and a smaller fourth spine some distance further back. The last joint of the eye-peduncles is but little longer than the preceding one. Antennules with the upper flagellum long (over one-half the length of the carapace) and strongly ciliated; lower flagellum scarcely as long as the peduncle. Peduncle of the antennæ long (nearly one-half the length of the carapace), the last two joints cylindrical and ciliated on the outer surface; flagellum curled, strongly ciliated on one side, and somewhat shorter than the peduncle. Ischium of the maxillipeds dentate on the inner margin and produced at the antero-internal angle; exognath reaching considerably beyond the middle of the merus. Chelipeds strong; merus short, stout, with one or more spines on the lower side; carpus scabrous externally, with the supero-distal angle produced into a large, compressed, triangular, spine-tipped tooth; at the base of this tooth the upper margin is armed with a variable number of spines, and there may be several small spines on the anterior edge; hand flattened, the outer surface scabrous and furnished with two spines, one near the base, the other behind the gap between the fingers; a spine near the middle of the lower margin, in front of which there may be several smaller ones; pollex broad, triangular, much compressed, with the inner margin armed with a variable number of spines; dactyl rather slender, curved, and spiny on the outer edge. The ambulatory legs have the anterior margins of the carpi spinulous and the antero-distal angles produced; dactyls subfalciform, but varying greatly in shape in the different pairs. The slender last pair of legs ends in a small, well developed chela. The lateral expansions of the fifth abdominal segment are subacute. The inner ramus of the uropods is narrower than the outer and articulated near the middle of the side of the peduncle, the outer one joined to the tip. Telson short, suborbicular, thick and convex in the middle, but with the sides laminate.

Length of carapace, 46.5 mm.; breadth of carapace, 35 mm.

Length of carapace, 47 mm.; breadth of carapace, 36 mm.

San Diego (Randall)! Monterey (Miers); Santa Monica, Calif.! Estero Bay! San Quentin Bay, Lower California!

Genus **Lepidopa** *Stimpson.*

Eye-peduncles lamellate, compressed, almost squamiform; corneæ rudimentary. Antennules long. Antennæ with a very small accessory joint; flagellum very short. Maxillipeds with the fourth joint produced at the antero-external angle into a lobe which reaches to or beyond the distal extremity of the fifth (penultimate) joint.

Type.—*L. scutellata* (FABR.)

Lepidopa myops *St.*

Lepidops myops STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 241. MIERS, Journ. Linn. Soc. (Zool.) London, Vol. XIV, 1879, p. 333, Pl. XIV, fig. 16.

Lepidopa myops ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. IX, 1896, p. 226.

Carapace oblong, with an obtuse median ridge, and marked with transverse grooves. Front trilobed, the median lobe rounded and shorter than the lateral lobes, which are acute. A spine at the antero-lateral angles. Posterior margin of the carapace deeply concave in the center. Ocular peduncles oblong, broadly rounded in front, the cornea when present minute and located on the margin near the antero-lateral angle. Antennules ciliated and over twice the length of the carapace. Antennæ shorter than the carapace; a thin lamina on the inner side of the basal joint; acicle minute; flaelglum scarcely as long as the peduncle. Chelipeds stout; hand high, and strongly compressed; pollex very short and curved; finger rather slender, curved, and, when closed, lying nearly at right angles to the long axis of the hand. The dactyls are compressed, falcate, dissimilar. The second, third, and fourth abdominal segments are furnished with wide, wing-like expansions which diminish in length and breadth posteriorly. Telson about as wide as long and rounded at the sides and apex.

Length of carapace, 15 mm.; breadth, 17 mm.

Cape St. Lucas (Stimpson); Lower California! San Diego (five specimens)!

The small teeth on the median frontal lobe mentioned by Stimpson are present on only a part of the specimens I have seen.

Subtribe GALATHEIDEA.

Rostrum present. Body flattened, the carapace divided by a lateral (anomoural) line. Abdomen flattened, the sides of the segments generally laterally produced. Tail-fin well developed. Pterygostomian regions free from the epistome. External antennæ four-jointed, the second and third joints fused; acicle small or absent. First pair of pereopods chelate; the last pair chelate, rudimentary, and folded in the branchial chamber.

Legion PORCELLANINEA.

Carapace broad, smooth. Antennules concealed. Antennæ long and generally furnished with a scale. Ischium of the maxillipeds broad and flattened; merus broad, with a prominent inner lobe. Chelipeds large, often flattened; first three pairs of ambulatory legs well developed; last pair slender, inflexed. Abdomen loosely bent under the trunk.

These crabs in the form of the carapace, the bend of the abdomen, and in their flattened maxillipeds resemble the true Brachyura; but these resemblances are not indicative of true affinity for both groups had, in all probability, an independent origin from Macrouran ancestors.

Genus **Petrolisthes** *St.*

Carapace subovate, depressed, generally longer than wide. Front triangular, entire or dentate, usually depressed, the margins more or less undulated. Eyes of rather large size. First basal joint of the antennæ very short, not reaching the upper margin of the carapace; the second joint is flattened and more or less cristate; flagellum long. Chelipeds broad and flattened; the carpus elongated, with or without teeth on the inner margin. The dactyls of the ambulatory legs are short and stout and terminate in a single claw.

Type.—*P. violaceus* (GUERIN).

Petrolisthes cinctipes (*Randall*).

Porcellana cinctipes RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 136.

Porcellana rupicola STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 85; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 480, Pl. XIX, fig. 2. BATE in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 276.

Petrolisthes rupicolus STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, p. 227. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 396. NEWCOMBE, Bull. Nat. Hist. Brit. Col., 1893, p, 30.

Petrolisthes cinctipes ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 278.

Carapace longer than wide, and quite distinctly areolated; the anterior portion is roughened by minute prominences and the branchial regions are transversely finely striated. Front triangular, depressed, blunt, transversely concave above, with a rounded notch on either side of the base next to the orbit. Antero-lateral margin marked by a raised line. Ocular peduncles somewhat flattened; superior margin of the orbit slightly concave. Antennal peduncle granulated; the flagellum may exceed one and one-half times the length of the carapace, and is furnished with a few setæ which are longer than the width of the joints. Ischium of the maxillipeds finely rugose, the distal margin transverse and broadly rounded; the outer border is prolonged into a lobe; the lobe on the inner side of the merus is prominent and distally rounded. Chelipeds granulated above; a small tooth at the antero-distal angle of the merus; carpus slightly tapering towards the distal end; no teeth on the anterior margin but the inner angle is prominent and evenly rounded; the posterior surface of the carpus is rugose, the upper edges of the projecting rugæ forming a rough ridge along the posterior margin which terminates distally in a tooth; hands strongly flattened, outer edge acute, nearly straight along the middle; tips of the fingers curved. Ambulatory legs more or less rugose, the merus expanded and nude; propodi hairy and furnished with a few short spinules near the distal end of the posterior margin; dactyls short, hairy, curved, acute, and generally furnished with a few minute spines below. The posterior pair of sutures in the telson is oblique.

Length, 20.5 mm; breadth, 19.75 mm.

Vancouver's Island (Bate, Newcombe); Humboldt County, Calif.! San Francisco Bay! Monterey! Santa Barbara! Santa Catalina Island! San Diego! San Miguel Island; west coast of Lower California and Gulf of California (Lockington).

This is one of the most common of our California crabs and is generally found under rocks at low tide. According to Ortmann (l.c.) "Die in Philadelphia aufbewahrten Originale Randall's zeigen, dass *cinctipes* dieselbe Art ist wie *rupicola*. Der von Randall angegebene fundort 'Sandwich-Ins.' beruht offenbar auf der unter seinem Material vorgekommenen Verwechslung der Localitäten." I am unable to follow Ortmann in uniting *eriomerus* St. with this species. The two forms occur together on a great part of the California coast and keep perfectly distinct.

Petrolisthes eriomerus *St.*

Petrolisthes eriomerus STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. X, p. 119. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 397.

Closely allied to *cinctipes*. Carapace smooth and punctate, though there are often minute prominences, especially anteriorly, which are not so marked as in the preceding species. Front not so strongly deflexed as in *cinctipes*. The antennæ may be over twice the length of the carapace and are devoid of setæ. Distal extremity of the ischium of the maxillipeds more or less truncated. Chelipeds longer and smoother than in *cinctipes;* the carpus is narrower and has the sides parallel; the antero-internal angle is much less prominent and the ridge on the posterior margin rougher. The merus joints of the ambulatory legs are hairy and less dilated than in the preceding species. The last pair of sutures on the telson is transverse or nearly so.

Humboldt County, Calif., to San Francisco Bay! Point Mendocino (Stimpson)! I have collected numerous species at the latter, or type locality. *Cinctipes* is also abundant in the same place.

Genus **Pachycheles** *Stimpson.*

Carapace round-ovate, or suborbicular, and not longer than wide, the posterior portion of the subbranchial region subquadrate and separated from the larger anterior portion by a membranous interval. Front but little produced, subacute, edentulous. First joint of the antennal peduncle produced and joined to the margin of the carapace; second joint at some distance from the orbit. Chelipeds thick and roughened; carpus short. Dactyls short and terminating in a single claw.

Type.—*P. grossimanus* (GUERIN).

Pachycheles rudis *St.*

Pachycheles rudis STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1862, p. 76; Proc. Acad. Nat. Sci. Phila., 1858, p. 228. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 404. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 30. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 294.

Carapace nearly smooth, quite strongly convex longitudinally, and finely striated on the branchial regions. Front short, deflexed, entire, and hairy above. Sides of the carapace evenly rounded and marked by a raised line. Sinus in the posterior margin deep and subacute in the middle. Superior margin of the orbit concave but not raised; outer angle of the orbit acute. Distal end of the ischium of the maxillipeds evenly rounded; inner lobe of the merus prominent, rounded. Chelipeds unequal, with a rough, irregular, granulated, or tuberculated upper surface, which is more or less hairy; merus with an anterior tooth; carpus short, about as broad as long, the anterior margin laminate, angular, and often furnished with one or more teeth; the posterior margin is convex and the upper surface bears two more or less evident longitudinal, granulated ridges; hands broad, subtriangular, very uneven above, and furnished with a rounded protuberance near the middle; the lower surface is glossy and very finely granulated at the center, but the granules become larger towards the margins; fingers stout, granulated. Ambulatory legs stout and more or less rugose; dactyls short, curved, and furnished with two or three spines below; posterior margins of the propodi with a few spines.

Length, 14.5 mm.; breadth, 15.25 mm.

British Columbia (Newcombe); Humboldt County, Calif., to San Francisco Bay! Monterey! Santa Rosa Is.! Santa Catalina Is.! Found under rocks at low tide. Lockington states that he found young specimens of this species in a bottle of material, without label, from Lower California.

Pachycheles pubescens, sp. nov.

Carapace suborbiculate, not so convex longitudinally as in *rudis*, and more or less distinctly areolated in front, where it is marked by small, transverse punctures. Branchial regions transversely striated. Sinus of the posterior margin of the carapace subacute and not nearly so deep as in the preceding species. Front entire moderately deflexed, somewhat produced and rounded in the center. The membranous interval separating the parts of the subbranchial region is nearly vertical. Eyes large. Antennal peduncle compressed. Superior orbital margin concave; postorbital tooth acute. The ischium of the maxillipeds is finely transversely rugose and the distal margin is more or less truncated. Upper surface of the chelipeds not rugose or tuberculated, but coarsely granulated and setose; granulations large, smooth, shining, generally transverse, those on the hand larger, becoming more acute towards the outer side, where they give rise to a denticulated margin; a tooth on the anterior margin of the merus; carpus generally a little wider than long, the anterior margin laminate and cut into three or four teeth armed with secondary denticles, which are most numerous on the proximal tooth; hand similar in shape to that of *rudis;* fingers stout, the inner margins hairy. Legs stout, setose. Propodi and dactyls spinulous below.

Length of carapace, 15 mm.; width, 15 mm.; length of carpus, 11.5 mm.; width, 11.5 mm.; length of hand, 22 mm.; width, 13 mm.

Drake's Bay, Calif.! Farallon Islands! Humboldt County, Calif.!

This species differs from *Pachycheles setimanus* (Lockington), the types of which I have examined, in its somewhat narrower carapace, more prominent front and broader pollex.

Collection of the University of California.

Legion GALATHEINEA.

Carapace elongated, generally rugose, and quite distinctly areolated; rostrum prominent, acute. Ocular peduncles short and stout, and lodged in incomplete orbits. Antennules not lodged in fossettes. Antennæ with the second and third joints often coalesced; flagellum long. Maxillipeds subpediform, the ischium and merus narrow. Chelipeds often slender and elongated. Fifth ambulatory legs feeble and inflexed. Abdomen broad and bent under the body; in the female the second to fifth segments generally bear appendages; in the male there are often sexual appendages on the first two segments, and the appendages on the three following segments may be well developed or rudimentary; the last pair of appendages is always well developed and forms, with the telson, a strong tail-fin.

Genus **Munida** *Leach.*

Carapace rugose, generally spinous, the cardiac area distinctly defined; the infero-lateral regions are not swollen out and are separated from the dorsal surface by a well defined margin. Rostrum slender and styliform, with a supraorbital spine on either side of the base. Ocular peduncles free; eyes normal. Chelipeds and ambulatory legs elongated and slender. One or more of the abdominal segments usually furnished with a series of spinules on the anterior dorsal margin.

Type.—M. rugosa (FABR.).

This genus is represented off the coast of California by a species *Munida (Grimothea) gregaria*, the *Galathea gregaria* of Fabricius, which still appears to be of uncertain systematic position. Miers considers it the young of *Munida subrugosa*, while Henderson thinks it doubtful that such is the case.[1] Owen[2] reports this species from "off San Francisco."

Genus **Pleuroncodes** *St.*

Near *Munida*. Carapace rugose, with the infero-lateral margins swollen out so that the sutures (anomoural lines) are visible from above. Rostrum styliform, with a supraorbital tooth on either side of the base. Ocular peduncles free; eyes large, normal. Insertion of the antennæ not concealed beneath the antero-lateral angles of the carapace. Merus of the maxillipeds unarmed, the penultimate joint slightly dilated.

Type.—P. monodon (MILNE-EDWARDS).

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[1] See Miers' Catalogue of New Zealand Crustacea, p. 168; Henderson, Challenger Reports Vol. XXVII, p. 124; and Milne-Edwards and Bouvier, Ann. Sci. Nat. (7), T. XVI, 1894 pp. 256 and 314.

[2] Zöology of Beechy's Voyage, Crustacea, 1839, p. 87.

Pleuroncodes planipes *St.*

Pleuroncodes planipes Stimpson, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 245. A. Milne-Edwards, and Bouvier, Ann. Sci. Nat. (7), T. XVI, 1894, pp. 248 and 245.

Closely allied to *P. monodon* from the coast of Chili. Carapace crossed by setose striæ but, with the exception of a few spinules behind the supraorbital teeth, devoid of spines. Rostrum long, very slender, scabrous above, and continued back upon the carapace as a carina; supraorbital teeth spine-like. A spine at the rounded antero-lateral angle of the carapace, behind which there are a few spines on the margin. Ocular peduncles not reaching the tip of the rostrum; eyes large. Maxillipeds with a small spine at the antero-internal angle of the ischium; penultimate joint moderately dilated. Chelipeds long, slender, and spinous; merus slender, trigonous, spinulous, especially on the edges, and generally exceeding the tip of the rostrum; carpus spinous; hand long, narrow, spinulous, with the upper and lower margins parallel; fingers slender, straight, longer than the palm, the tips curved. Ambulatory legs scabrous, ciliated, with the penultimate joints flattened. Abdomen devoid of spines.

"This species," says Stimpson, "lives in the open ocean, and is sometimes found in vast quantities in the Pacific off the American Coast. It was taken by Mr. Grayson in N. lat. 24°, W. lon. 130°. In March, 1859, it was thrown ashore in considerable numbers at Monterey, California."

Ninety miles southwest of San Francisco, Calif.! 150 miles southwest of Cape St. Lucas, Lower California, numerous specimens!

Subtribe PAGURIDEA.

Carapace with a lateral (anomoural) line. Pterygostomian regions free from the epistome. External antennæ with a five-jointed peduncle and, generally, with an acute, movable acicle. First pair of pereopods large, chelate, often unequal; last pair small and generally more or less chelate. Abdomen asymmetrical, the lower and often the upper side membranous; the appendages generally reduced or absent, and commonly occurring only on one side.

Legion LITHODINEA.

Carapace broad, often resembling that of the Brachyura. Rostrum generally well developed. Third ambulatory legs subequal to the preceding pair; last pair feeble, chelate, and folded in the branchial chamber. Sternum wide. Abdomen bent under the thorax; in the male it is devoid of appendages, but in the female the first segment may bear a small pair, and each of the four following segments often has an appendage only on the left side.

KEY TO THE GENERA OF *Lithodinea*.

Carapace smooth and produced laterally into two wings, which conceal the ambulatory legs.......................... *Cryptolithodes*.
Carapace not so produced.
  Carapace devoid of spines or tubercles on the upper surface.
    Carapace much flattened, hairy..................... *Hapalogaster*.
    Carapace not much flattened; acicle curved.......... *Œdignathus*.
    Carapace not much flattened; acicle straight........ *Dermaturus*.
  Carapace with spines or tubercles above.
    Carapace with deep pits above..................... *Phyllolithodes*.
    Carapace not deeply pitted.
      Abdomen membranous. Carapace spiny.... *Acantholithodes*.
      Abdomen furnished with calcareous plates.
        Carapace tuberculated .... *Lopholithodes*.
        Carapace spiny............................ *Lithodes*.

Genus **Hapalogaster** *Brandt*.

Carapace flattened and marked with chitinous, uncalcified lines; lateral margin with teeth or spines. Last joints of the external maxillipeds dilated. Chelipeds depressed, very unequal; hands more or less trigonal, moving horizontally. Ambulatory legs depressed. Abdomen soft, loosely inflexed, the basal segment with a transverse, calcareous plate on either side.

Type.—*H. Mertensii* BRANDT.

Hapalogaster cavicauda *St.*

Hapalogaster cavicauda STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 81, Pl. I, fig. 7; Proc. Acad. Nat. Sci. Phila., 1858, p. 232. SCHALFEEW, Mélan. biol., Tome XIII, p. 326, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, p. 332. BOAS, Vid. Selsk. Skr., 6 Rœkke, Natur. og Math., Afd. 1, 2, 1894, p. 194, Pl. VI, fig. 200. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1894, p. 166, Pl. XI, fig. 2, and Pl. XII, figs. 1, 15, 27 and 29; *Ibid.* (8), Tome I, 1896, p. 2, et seq.

Body and legs much flattened and densely covered with short hair. Carapace subcordate, nearly smooth, but roughened or granulated at the insertions of the hairs. Front short, acute, narrowly triangular. Postorbital tooth large, acute, and extending nearly as far forward as the front. Superior orbital margin concave and furnished with a small, acute tooth which is separated from the postorbital by a deep fissure. The portion of the antero-lateral margin in front of the cervical groove is convex, sublaminate, edentate, and separated from the portion behind the groove by an incision; two marginal teeth at the origin of the sutures. Ocular peduncles short, hairy, and swollen at the base, where they are furnished with a small, smooth tubercle. Antennæ about as long as the carapace; acicle ovate, acute, very thin, more or less transparent, and margined by hairs on both sides; a smooth, slender spine joined beneath, and reaching nearly to the tip of the acicle. Second joint of the palp of the maxillipeds with a rounded inner lobe; last joint rounded distally and somewhat flattened. Chelipeds flattened, not tuberculated, anterior margin of the merus produced and cut into two teeth; carpus produced into a tooth at the postero-distal angle and bearing a single spine at the proximal end of the anterior margin; larger hand with one or more small, calcareous tubercles on inner face behind the articulation of the dactyl; inner margin of the smaller hand produced into a rounded lobe behind the base of the dactyl; the fingers of the smaller hand are excavated within, the edges corneous and armed with small, calcareous denticles. Ambulatory legs much flattened and very hairy, the anterior margins deeply incised, forming four or five closely approximated teeth on each of the larger joints; postero-distal angle of the carpi produced into a tooth or lobe which is very prominent on the third pair; dactyls short, flattened, the curved, corneous tips turned obliquely to the plane of compression. The abdomen is broad and bent abruptly at about the third segment, the reflexed portion not so hairy as the upper side; the calcareous plates on the basal segment are wide and separated by a membranous interval in which there is no median plate. In the female the left side of the abdomen is coriaceous and segmentally incised.

Length of carapace from tip of rostrum, 17 mm; breadth, 19 mm.; length of large hand, 28 mm.; length of small hand, 20 mm.

Northern to southern California! Monterey (Stimpson)! Found under rocks at low tide. Common.

Hapalogaster Mertensii *Brandt.*

Hapalogaster Mertensii BRANDT, Mélanges biologiques, Tome I, 1850, p. 58. STIMPSON, Journ. Bost. Soc. Nat. Hist, Vol. VI, 1857, p. 480. SCHALFEEW, Mélang. biol., Tome XIII, 1892, p. 327, figs. 4 and 5*a*, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, 1892, p. 333. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 28. BOUVIER, Ann. Sci. Nat. (8), Tome I, 1896, p. 4 et seq.

Carapace with scattered tufts of setæ on the upper surface. Rostrum acuminate, longer than in *cavicauda.* A large, sharp spine at the outer orbital angle, and a smaller sharp spine on the superior orbital margin, separated from the last by an incision. No marginal spines in front of the cervical groove, but behind it there are five slender spines which decrease in size posteriorly. Merus of the large cheliped armed in front with a pair of large spines having a small spine on either side; carpus armed with several spines subserially arranged; hand narrow, with three rows of large spines on the outer surface and a row of smaller spines on the upper edge; in the smaller hand there are four spines on the outer border, three on the inner edge, a row of three spines on the upper surface near the inner side, and a single spine between this row and the outer edge near the gap between the fingers. Ambulatory legs armed with sharp spines on the anterior margin.

Described from five specimens in the National Museum from Kadiak, Alaska (No. 19471), collected by W. J. Fisher.

Sitka (Brandt); Kadiak (Schalfeew)! British Columbia (Bouvier); near Victoria (Newcombe).

Hapalogaster Grebnitzkii *Schalfeew.*

Hapalogaster Grebnitzkii SCHALFEEW, Mélang. biol., Tome XIII, 1892, p. 329, figs. 3*a* and 3*b*, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, 1892, p. 335. BOUVIER, Ann. Sci. nat. (8), Tome I, 1896, p. 4 et seq.

Closely allied to *Mertensii.* Carapace devoid of prominent tufts of setæ. Rostrum prominent, acuminate; a large spine at the outer orbital angle and a sharp spine on the superior orbital margin which is relatively larger than the corresponding spine in the preceding species. Margin of the carapace behind the cervical groove armed with five spines, which decrease in size posteriorly. Legs armed with setose spines. The merus of the large cheliped is similar to that of *Mertensii*, but the carpus has fewer spines above; hand shaped as in *Mertensii*, but having only two rows of spines on the outer surface and a row of small spines on the inner edge; there is a broad, smooth interval on the outer surface, which in *Mertensii* is armed with the median row of spines. The number and arrangement of the spines on the smaller hand is the same as in the preceding species, with the exception that there is no spine behind the gap between the fingers.

Described from numerous specimens in the National Museum from Humboldt Bay (No. 19443, Albatross collection); Behring Is., Kadiak Is. (Schalfeew).

Genus **Dermaturus** *Brandt.*

Carapace more or less lyrate, devoid of prominent spines or tubercles and marked with transverse striæ; lateral margins unarmed. Rostrum triangular, simple. A small tooth on the margin of the orbit within the outer orbital angle. First and second joints of the antennæ with a spine at the outer angle; acicle oblong, straight; last two joints of the peduncle subcylindrical. Last two joints of the maxillipeds not dilated. Chelipeds very unequal, not flattened; hands rounded, fingers excavated within. Ambulatory legs subcylindrical; dactyls spiny below and armed with long, sharp claws. Abdomen soft, loosely inflexed.

Type.—D. Mandtii BRANDT.

Dermaturus Mandtii *Brandt.*

Dermaturus Mandtii BRANDT, Bull. phys.-math. Acad. imp. sci. St. Petersb., Tome VIII, 1850, p. 50; Mélanges biologiques, Tome I, 1850, p. 58. STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, p. 232. BOUVIER, Ann. Sci. nat. (7), Tome XVIII, 1895, p. 173; *Ibid.* (8), Tome I, 1896, p. 19.

Hapalogaster Mandtii SCHALFEEW, Mélang. biol., Tome XIII, 1892, p. 332, figs. 2 and 5c, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, 1892, p. 338.

Carapace narrowly lyrate, not much wider behind than in front, the upper surface unarmed, but marked with prominent, transverse striæ, the anterior edges of which are furnished with short, appressed setæ. Rostrum prominent triangular, having a minute knob of granules just behind the acute tip. Outer orbital angles acute, reaching about as far forward as the middle of the rostrum; a small, but prominent tooth on the transverse posterior margin of the orbit a short distance internal to the outer angle. Eye-peduncles with transverse, setose ridges. The spine at the outer angle of the second joint of the antenna is long and narrow, reaching beyond the middle of the acicle; acicle narrow, oblong, straight, the tip rounded, the margins, especially the inner, setose. The last two joints of the maxillipeds are not dilated. Chelipeds with transverse granulated ridges which are furnished with a fringe of appressed setæ on the distal side; merus of the large cheliped with 5–6 teeth on the anterior margin; carpus armed in front with three teeth, the proximal one being quite prominent; hand crossed by double rows of granules which become broken up into separate groups on the pollex; fingers with tufts of setæ; merus of the small cheliped armed in front with several spines which decrease rapidly in size towards the distal end; anterior margin of the carpus with three teeth, the proximal one much the largest; hand narrow, anterior margin of the palm with four small teeth at the ends of lines of granules; fingers hairy, longer than the palm; a group of granules above the base of the dactyl. Ambulatory legs crossed with setose striæ; claws long and sharp.

Described from two specimens obtained from the National Museum.

Pribyloff Is. (Brandt); Kadiak Is.; Behring Is. (Schalfeew); lat. 55° 34′ 30″ N.; lon. 162° 31′ 45″ W.; 19 fathoms!

Genus **Œdignathus** *Benedict.*

Carapace lyrate, convex, devoid of spines or tubercles and furnished with a short simple rostrum. Antennal acicle flattened, the inner margin thick and concave, the outer thin and convex; last two joints of the peduncle subcylindrical; flagellum long. Maxillipeds subpediform; the last two joints dilated. Chelipeds unequal; tips of the fingers excavated within. First three pairs of ambulatory legs subequal, subcylindrical; dactyls with curved, corneous claws. Abdomen soft, thick, broad, and loosely inflexed, the basal, and to a less extent, the last two segments strengthened by calcareous plates.

Type.—O. Brandti (SCHALFEEW).

This genus is closely allied to *Dermaturus* with which it has been united by Bouvier. It differs from *Dermaturus* in having a more or less crescent-shaped acicle, in the different marking of the carapace, and in not having the last two joints of the maxillipeds dilated.

Œdignathus Brandti *(Schalfeew)*.

Hapalogaster Brandti SCHALFEEW, Mélang. biol., Tome XIII, 1892, p. 330, figs. 1 and 5*b*, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, 1892, p. 336.

Œdignathus Gilli BENEDICT, Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 487.

Dermaturus Gilli BOUVIER, Ann. Sci. nat. (8), Tome I, 1896, p. 19.

Carapace lyrate, convex above, and covered with flat scale-like plates which are setose on the anterior margin. Rostrum short, triangular, acute and curved downwards. Outer orbital angle subacute, the inner orbital tooth represented by a minute prominence. Upper surface of the antennal acicle furnished with minute spines; lower surface smooth. Chelipeds very unequal and covered with low, granulated, wart-like tubercles; in the larger cheliped the anterior margin of the merus is produced and cut into three or four teeth; the anterior margin of the carpus is furnished with a jagged tooth near the base; the hand is large and swollen, the fingers are somewhat gaping at the base, the tips excavated within. In the smaller cheliped the process on the anterior side of the merus is generally cut into two small teeth; a tooth on the anterior margin of the carpus; the hand is narrower and less tumid than in the large cheliped; the fingers are deeply excavated within and meet along the entire inner margin; outer margin corneous like the tip and armed with a few small teeth. Ambulatory legs more or less hairy; a group of small spines on the infero-distal angle of the propodi; dactyls ending in black, curved, acute tips and armed below with five or six black spines. Abdomen covered with a short pubescence; the margins fringed with long hairs; the calcareous plates on the last two segments inconspicuous. Four two-jointed, uniramous appendages on the left side of the abdomen in the female. The margin of the left side of the abdomen in the female is hardened and segmentally incised, but this is not the case in the male.

Length of carapace from tip of the rostrum to the posterior emargination, 15.5 mm.; breadth, 15.5 mm.; length of large cheliped, 40 mm.; length of small cheliped, 28 mm.

Alaska (Benedict)! British Columbia! Humboldt County, Calif., to San Francisco Bay!

This species is often found on the rocks among the mussels. It may be easily recognized by its lyrate carapace covered by the very peculiar scale-like plates and the very unequal chelipeds with their wart-like tubercles.

Through the kindness of Mr. Benedict I have examined the types of his *Gilli* (No. 18525, U. S. Nat. Mus.).

Œdignathus inermis *(St.).*

Hapalogaster inermis STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 243. SCHALFEEW, Mélang. biol., Tome XIII, 1892, p. 326, du Bull. Acad. imp. sci. St. Petersb., Tome XXXV, 1892, p. 332. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 28. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1895, p. 172.

Dermaturus inermis BOUVIER, Ann. Sci. Nat. (8), Tome I, 1896, p. 19.

"Carapace longer than broad, smooth above except where some minute transverse, setose scabrosities or minute squamæ are sparsely distributed, occurring most abundantly toward the sides. Margins unarmed, smooth. No sinus at the juncture of the cervical suture with the lateral margin. Rostrum convex above, almost carinated; apex scarcely acute. Inner orbital tooth minute, inconspicuous. Outer orbital tooth (antero-exterior angle of the carapax) far less prominent than the rostrum. Acicle rather short and broad, irregularly somewhat dentated along the exterior margin. Feet subcylindrical, almost naked, rugose above with minute and somewhat rounded setose tubercles; dactylus three-fourths as long as the penult joint and armed with a long unguiculus. Plates of the first joint of the abdomen narrow.

"Length of carapax, 0.4; breadth posteriorly, 0.38 inch."

Puget Sound (Stimpson); Queen Charlotte Is. (Newcombe); Sitka (Schalfeew).

Judging from Stimpson's description, *O. Brandti* is very closely related to this species and not improbably will prove identical with it. The setose squamæ in the specimens of *Brandti* I have seen were thickly set instead of "sparsely distributed," the upper surface of the carapace being almost entirely covered by them, except a small, narrow area along the median line, where they were small and scattered. Stimpson's specimen was probably immature and the character that separates *Brandti* may be due to age. In all the characters except the abundance and distribution of the squamæ *Brandti* agrees with Stimpson's description. Schalfeew considered his *Brandti* closely allied to, if not identical with *inermis*, and Bouvier, who had a specimen of the latter at hand, states that it agrees perfectly with the description and figures of *Brandti*. The specimen Bouvier called *inermis*, however, may not have been that species, for if it agreed perfectly with Schalfeew's description and figures of *Brandti*, it could not agree perfectly with Stimpson's description of *inermis*. The figure of *Brandti* shows the squamæ on the carapace to be thickly set.

Genus **Acantholithodes** *Holmes*.

Carapace lyrate, flattened, and covered with setose spines. Rostrum prominent and terminated by strong spines. The first basal joint of the antennæ has one or more spines on the outer side; the second basal joint is produced forwards on the outer side into a long, pointed process whose outer margin is armed with several strong spines; acicles pointed, spiny, joined to the end of the second joint above the spiny process; fourth and fifth basal joints subcylindrical. The ischium of the maxillipeds is widened, produced forward at the antero-internal angle, and dentate on the inner margin; the last two joints of the palp are not markedly dilated. The legs are covered with setose spines; chelipeds of moderate size; more or less unequal; fingers excavated within and furnished with calcareous teeth and corneous extremities. First of the three pairs of ambulatory legs subequal. Abdomen soft, the integument spiny; the first and last two segments strengthened by calcareous plates.

Type.—*A. hispidus* (STIMPSON).

Acantholithodes hispidus *(St.)*.

Dermaturus hispidus STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 242. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, p. 174 et seq., Pl. XI, figs. 3 and 16; 1894, Pl. XII, figs. 2, 16, and 31; *Ibid.* (8), Tome I, 1896, p. 19.

Acantholithodes hispidus HOLMES, Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 575.

Carapace flattened, lyrate, covered with long setose spines, which become somewhat larger towards the margins. Median region tumid and separated from the cardiac by a very deep, transverse sulcus; a prominent depression between the median and branchial regions. Rostrum quite large and ending in three spines; a large fourth spine above and behind the median one.

Eye-peduncles hispid and retractile against the anterior margin of the carapace. Antennules large. Antennæ shorter than the carapace; first basal joint with a spine on either side; second joint produced into a long acute process whose outer margin is armed with four or five spines; acicle narrow, acuminate, armed externally with numerous spines and about equaling the lower spiny process. Ischium of the maxillipeds with two small, subconical teeth on the outer surface near the antero-internal angle; merus hispid, not dilated, and longer than the ischium; last joint of the palp flattened below. Chelipeds unequal, very spiny; two or three very large spines on the anterior margin of the merus and carpus; in the larger hand the palm is inflated, the fingers deflexed, shorter than the palm, excavated within, corneous tipped, and furnished with calcareous, molar-like teeth. In the smaller hand the palm is not so strongly inflated, the fingers are longer and straighter and more deeply excavated within; the corneous tips are more extensive and the calcareous teeth are smaller and more numerous. Ambulatory legs spiny, somewhat compressed; dactyls about two-thirds the length of the propodi. Abdomen short, broad, and soft, the spines not so large as on the carapace; on the basal segment there is a median plate and two wide lateral ones; the plate on the penultimate segment is oblong; the last one is small, rounded, and about as long as wide.

Length of carapace from tip of rostrum, 58 mm.; width of carapace, 56 mm.

Monterey (Stimpson)! Vancouver's Is. (Whiteaves); "California"!

A rare species. Stimpson's description was drawn from a small female which was somewhat broader than long, .85 in. by .9 in. Our description is taken from a single male from Monterey collected by Dr. Ritter.

Genus **Phyllolithodes** *Brandt.*

Carapace triangular, and provided with rounded tubercles which surround an excavated area on the dorsal surface; lateral margins armed with spines. Rostrum prominent, ending in two cornua. Acicle of the antennæ cut into prominent lobes. Chelipeds unequal, spinose. Ambulatory legs subcylindrical and armed with spines. Abdomen furnished with calcareous plates in which is a central membranous area.

Type.—P. papillosus Brandt.

Phyllolithodes papillosus *Brandt.*

Phyllolithodes papillosus BRANDT, Bull. phys.-math. Acad. St. Petersb., Tome VII, 1849, p. 175. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 476; Proc. Acad. Nat. Sci. Phila., 1858, p. 231; Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1862, p. 80; WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1895, p. 174, Pl XI, fig. 12; Pl. XII, figs. 14 and 25; Pl. XIII, fig. 1; *Ibid.* (8), Tome I, 1896, p. 22.

Petalocerus bellianus WHITE, Proc. Zool. Soc. London, 1856, p. 134, Pl. XLII; Ann. Nat. Hist. (2), Vol. XV, 1855, p. 307. BATE, Proc. Zool. Soc. London, 1864; in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 275.

Carapace triangular and covered with strawberry-like tubercles which form a smaller elevated triangle whose sides are parallel to the sides of the carapace; a pair of large, deep pits on the dorsal surface. Rostrum prominent, divided into two, blunt, diverging, obliquely compressed horns, and bearing on the upper side a high, bilobed crest. On the under side of the rostrum there is a spiny process directed forwards and curving slightly upwards, above the base of which is a pair of much smaller spines. Antero-lateral margin constricted behind the hepatic regions. A subacute spine at the outer orbital angle which is directed forwards, downwards, and slightly inward; two spines of unequal length just external to the postorbital; behind the constriction, the antero-lateral margin is armed with three, long, slender, rather blunt spines which exceed the anterior ones in length. The postero-lateral angles of the carapace are produced outwards into flattened expansions which bear three blunt projections, the anterior one of which is elongated, slightly compressed, pointing upwards, outwards and forwards; the posterior projection is short and rounded. Posterior margin of the carapace transverse and furnished with a row of rounded tubercles. Antennal acicle furnished with three smooth, flattened, subequal, spatulate processes. The chelipeds are unequal and thickly covered with long, slender, more or less compressed, blunt spines, which are largest on the merus and carpus and gradually diminish in size toward the tip and lower margin of the hand; the two hands are similar; fingers stout, corneous-tipped, and excavated, the outer sides furnished with numerous tufts of setæ. Ambulatory legs subequal, subcylindrical, and thickly covered with long spines similar to those of the chelipeds. Basal abdominal segment nearly vertical and deeply pitted on either side like the following segments.

Length of carapace from tip of the rostral horn, 52 mm.; width between tips of postero-lateral horns, 51 mm.

Kadiak Is. (Brandt); Vancouver's Is. (Bate, Whiteaves); Monterey (White); "California", several specimens!

Phyllolithodes bicornis *(Bate).*

Petalocerus bicornis BATE, Proc. Zool. Soc. London, 1864, p. 664; in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 271.
Phyllolithodes bicornis BOUVIER, Ann. Sci. Nat. (8), Tome I, 1896, p. 22.

This species is evidently closely allied to *papillosus.* The carapace is "anteriorly produced into two, horizontal, horn-like processes. The second pair of antennæ have a compound scale, consisting of two large and two short compressed processes, and a third joint is furnished with two or three sharp, short strong processes." This species differs from *papillosus,* according to Bate, "in having a horizontal, bifurcate rostrum to the carapace, being more distinctly tuberculated, and in the pereopoda being more strongly spinated."

Color, yellow, with purple between the tubercles.

"Dredged in Esquimalt Harbor in ten fathoms of water."

The character of the rostrum does not distinguish this species from *papillosus,* as I have seen in the latter species all stages between prominent rostral spines and short, blunt knobs. Of the other distinguishing characters I cannot speak. Had not Bate specimens of *papillosus* from near the same locality for comparison, one would be inclined to regard this species as a synonym of the preceding one.

Genus **Cryptolithodes** *Brandt.*

Carapace transverse, nearly smooth, high in the middle and produced laterally into two wing-like expansions which cover the ambulatory legs. Rostrum broad, flattened, deflexed. Antero-lateral margins arcuate, often dentate, and meeting the postero-lateral margins at an angle. Ocular peduncles quite slender and approximated at their enlarged bases. Antennules separated by a considerable interval, the first joint enlarged. First basal joint of the antennæ very short; second joint with a crest above and a large process on the outer side; acicle broad and laminate; flagellum rather short. Ischium of the maxillipeds small, the inner margin denticulated; merus with the outer surface flattened; joints of the palp compressed. Chelipeds unequal and more or less covered by the carapace; hands stout, compressed, the fingers excavated within. The three anterior pairs of ambulatory legs are subequal, crested above for a part of their length; dactyls with curved, acute tips. Abdomen flattened, triangular, fitting neatly into a depression in the sternum; behind the entire basal segment the abdomen bends abruptly, and the three following segments are divided into a median row of plates with a series of lateral plates on either side; the penultimate segment is devoid of lateral plates and conceals the minute, triangular telson.

Type.—*C. typicus* BRANDT.

Cryptolithodes typicus *Brandt.*

Cryptolithodes typicus BRANDT, Bull. phys-math. Acad. St. Petersb., Tome VII, 1849, p. 175; and Tome XI, 1853. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 472, Pl. XIX; Proc. Acad. Nat. Sci. Phila., 1858, p. 231. BATE, Proc. Zool. Soc. London, 1864; in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 271. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1895, p. 189, and (8), Tome I, 1896, p. 28.

Carapace very wide. Rostrum very much deflexed, not distally widened, the upper surface rounded, the anterior extremity truncated with the angles rounded. Lateral angles of the carapace acute; the posterior margin bulges outward very slightly in the middle. Seen from below the carapace is strongly concave and not at all flattened out towards the sides. The depression between the cardiac and median region is shallow. Teeth on the posterior margin of the carapace obscure; those on the antero-lateral margin small. Orbital sinus much less deep than in *sitchensis.* Chelipeds very low, rounded tubercles; large hand with the outer surface tuberculated and the upper side rounded; small hand acute above. The merus joints of the ambulatory legs are furnished below with a deep groove bounded by the sharp, produced, lower margins. Abdomen crossed by transverse ridges.

Described from a small, dried specimen in the U. S. National Museum (No. 3475) collected by Dall at Belkoffsky Bay, Alaska (25 fathoms).

Northern California (Brandt); Monterey (Stimpson); Vancouver's Is. (Bate).

Cryptolithodes sitchensis *Brandt.*

Cryptolithodes sitchensis BRANDT, Bull. phys.-math. Acad. imp. sci. St. Petersb., Tome XI, 1853, p. 133; Mélanges biologiques, Tome I, p. 654. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 476; Proc. Acad. Nat. Sci. Phila., 1858, p. 231. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 26, Pl. XI. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1895, p. 189, Pl. XI, figs. 11 and 15, Pl. XII, fig. 26; *Ibid.* (8), Tome I, 1896, p. 28.

Cryptolithodes alta-fissura BATE, Proc. Zool. Soc. London, 1864, p. 665; Ann. Nat. Hist. (3), Vol. XV, p. 485; in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 271.

Carapace transversely subelliptical; median region high and surmounted by a ridge or crest, which extends to the middle of the front anteriorly; a pair of transverse ridges extending upon the hepatic region from the sides of the median elevation. Behind the median region the carapace is much inflated and rounded and furnished with a rounded elevation behind the depression at the posterior end of the median area. Median ridge obsolescent on the posterior portion of the carapace. Surface of the carapace smooth, microscopically very closely punctated, and furnished here and there with very small, rounded tubercles which, in some specimens, are almost entirely absent. The rostrum is deflexed at an angle of about 45 degrees and widened towards the distal end, which is transverse and furnished with a small median tooth. The lateral expansions of the carapace are produced forwards to about two-thirds the length of the front, forming a large deep, rounded, orbital sinus on either side. The antero-lateral margins are strongly arcuated, curving most sharply a little in front of the middle, the posterior third being almost straight and much more nearly longitudinal than transverse; the antero-lateral teeth are eight to ten in number and separated by concave interspaces of variable length; they are small and variable, often subacute, but sometimes represented by small undulations. The lateral angles of the carapace much exceed 90 degrees, and the lateral teeth are larger than those in front. Posterior margin strongly arched, and generally devoid of teeth, although there may be one or two small ones near the lateral angles. A very prominent longitudinal crest on the pterygostomian regions. The ocular peduncles are smooth, bent upwards, and flattened above, the bases much enlarged. The superior crest on the second joint of the antennæ is short and high and the laminate outer process is triangular, produced at the postero-external angle, and extending forward in a sharp point considerably exceeding the fourth joint of the peduncle; the fifth joint is strongly compressed, having a high, thin crest on the upper side, which is produced at the distal end; flagellum nearly naked, scarcely as long as the peduncle; the acicle is very thin, unarmed, about as wide as long, concave above, very strongly curved externally, the upturned inner margin somewhat irregular and nearly straight. The ischium of the maxillipeds is small, trigonal, the outer angle furnished with a small tooth; of the two edges which face the middle line, the inner one is the longer and finely denticulated, the outer one is furnished with two rounded teeth; the merus is smooth, flattened, strongly produced at the outer angle, the inner and outer margins sharp, the outer surface transversely concave; the joints of the palp are strongly compressed and crested above. Chelipeds stout; inner margin of the ischium acute; inner margin of the merus with a compressed (occasionally subconical) tooth; the carpus has a ridge on the outer surface, an acute projecting distal margin, and a tooth over the upper hinge joint of the hand; hands smooth, compressed, with a single, rounded, longitudinal ridge a little below the middle of the outer surface; the high upper crest is produced at the distal end; fingers short and stout, dactyl with a superior crest which is most prominent at the proximal end. Ambulatory legs smooth, naked, strongly compressed, with the upper edges acute; the lower side of the merus is flattened, not deeply grooved as in *typicus;* the acute inferior margin of the propodi ends distally in a short spine; dactyls spinulous below, about three-fourths the length of the propodi. The sides of the abdomen in the male are nearly straight, but in the female they are convex and more or less unequal; the basal joint is nearly vertical, with a depression on either side of the center; the posterior side more strongly concave in the female than in the male; the sutures of the median and lateral pieces alternate, those between the lateral pieces being transverse in the male but oblique on one side in the female, the penultimate segment is oblong, distally widened, and concave at the distal end; the telson is very small and fits into the space between the bases of the chelipeds.

	Length of Carapace.	Width of Carapace.
Male	47 mm	64 mm.
"	36 mm	53 mm.
"	35 mm	50 mm.
"	32 mm	47 mm.
"	16 mm	23 mm.
Female	36.5 mm	49.5 mm.
"	25 mm	36 mm.

The males I have seen in a fresh condition were all of a uniform, bright red color. Two females seen were red but with a purplish tinge irregularly marked with blotches of a lighter color. This species is often seen at low tide on the sides of rocks where, at some distance, it might readily be mistaken for a species of bright red incrusting sponge which is found in similar situations.

Near Sitka (Brandt); Alaska! Vancouver's Island (Bate); Victoria; Queen Charlotte Island (Newcombe); British Columbia (Bouvier); Port Townsend! Cape Mendocino! Point Arena, Calif.!

In young specimens the posterior margin of the carapace is straighter than in adults; the ridge on the outer surface of the hand is plainer and there may be one or more additional ridges more or less plainly visible. In females the posterior portion of the carapace is very tumid, and the posterior margin bulges backwards more strongly than in the males.

Cryptolithodes brevifrons *Miers.*

Cryptolithodes brevifrons MIERS, Proc. Zool. Soc. London, 1879, p. 48, Note. BOUVIER, Ann. Sci. Nat. (8), Tome 1, 1896, p. 28.

This species is described in a foot-note as follows:

"There is a dried specimen in the [British] Museum from Vancouver's Island which closely resembles *C. typicus*, but is distinguished by the form of the rostrum, which is obtusely triangular, and does not project beyond the anterior margin of the carapax. This I propose to call *C. brevifrons.*"

Genus **Lopholithodes** *Brandt.*

Carapace broad, pentagonal or hexagonal, convex above; with the margins and upper surface armed with setose tubercles. Rostrum short, spiny. Acicle of the antennæ with the margins and generally the upper surface spiny. The terminal joint of the mandibular palp is elongated and flattened, and bent backward so as to lie between the concave inner faces of the mandibles. Chelipeds unequal, tuberculated; carpus with a prominent lobe on the inner side. Ambulatory legs short, tuberculated, and capable of being folded under the carapace. Basal segment of the abdomen entire, the three following segments with lateral plates and also small marginal plates on one or both sides; penultimate joint devoid of lateral plates; telson very small.

Type.—*L. Mandtii* BRANDT.

Large crabs of rough aspect, confined to the Pacific Coast of North America.

In this genus the chelipeds and ambulatory legs, when folded, fit neatly together, thus affording protection to the mouth-parts and under side of the body in a very effective manner.

Until the present time *Lopholithodes* Brandt has been ranked as a synonym of *Echinocerus* White, the date of Brandt's genus being given as 1849 and that of White's as 1848. But while Vol. VII of the Bulletin of the St. Petersburg Academy of Sciences bears the date 1849, the number containing the description of *Lopholithodes* bears the date of publication June 29, 1848. The part of the Proceedings of the Zoological Society of London in which White's description of *Echinocerus* appeared was received from the printer November 14, 1848. The name *Lopholithodes*, therefore, has priority.

Lopholithodes Mandtii *Brandt*.

Lopholithodes Mandtii BRANDT, Bull. phys.-math. Acad. St. Petersb., Tome VII, 1849, p. 174.

Echinocerus cibarius WHITE, Proc. Zool. Soc. London, 1848, p. 47, Pls. II and III; Cat. of Crust. in Brit. Mus., p. 56. STIMPSON, Journ. Bost. Soc. Nat. Hist. Vol. VI, 1857, p. 477; Proc. Acad. Nat. Sci. Phila., 1858, p. 231. BATE, in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 276. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 26. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1894, p. 184, Pl. XI, fig. 13, Pl. XII, figs. 13 and 24; *Ibid.* (8), Tome I, 1896, p. 27.

Ctenorhinus setimanus GIBBONS, Proc. Cal. Acad. Sci., Vol. I, 1855, p. 48.

Echinocerus sentimanus STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist. Vol. VI, 1857, p. 477; Proc. Acad. Nat. Sci. Phila., 1858, p. 231. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1894, p. 184; *Ibid.* (8), Tome I, 1896, p. 27.

Carapace strongly convex, wider than long, the whole surface—the large tubercles as well as the intervening spaces—roughened by small short, setose tubercles which vary greatly in size from low, nearly smooth swellings to rough, subconical projections. Median region very prominent, having a subconical apex a little in front of the middle and a cluster of small, rounded, or subacute tubercles near the posterior end; a large, subconical elevation on the cardiac region in front of which, on either side, is a depressed, comparatively smooth area; median and cardiac areas separated by a comparatively smooth sulcus; a large subconical elevation on the branchial regions and two smaller tubercles on the posterior margin of the carapace. A peculiar smooth wart-like prominence on either side of the median area. Rostrum short and consisting of a strong subconical spine above the base of which is a knob bearing two lateral spines or tubercles with (generally) a spine or tubercle above and below the notch between them. A deep, rounded sinus on either side of the front which serves as an orbit, external to which is an acute spine; beyond this spine is a large spine which extends nearly as far forwards as the rostrum and in the sinus between the latter spine and the postorbital there is generally a small spine or tooth. The antero-lateral margin is armed with a variable number (about eight) of prominent spines and several smaller ones; the middle portion is convex, flattened, and produced. A large, knob-like prominence at the postero-lateral angles which is separated from the last antero-lateral spine by a conspicuous sinus. Ocular peduncles two-jointed, thickly set with spines above, and not nearly reaching the tip of the rostrum. Acicle of the antennæ narrow, tapering, much exceeding the tip of the peduncle, and furnished with about thirty strong, smooth, sharp spines. Ischium of the maxillipeds armed within with dark-colored teeth; a tooth on the outer surface near the antero-internal angle; exognath somewhat exceeding the merus. Chelipeds short, the first and second joints with irregular tuberculous projections on the under side; one or more prominent spines on the antero-internal angle of the merus; the lobe on the inner side of the carpus is very large and acute and margined with sharp, spine-like tubercles; spines on the outer surface of the hands large and numerous; four or five large spines on the upper margin of the larger hand and three or four on that of the smaller. Ambulatory legs subequal, strongly tuberculated, quadrangular at the base; carpi and propodi subcylindrical but very irregular; dactyls short and stout. The basal abdominal segment is strongly concave behind, especially in the female, and nearly at right angles to the carapace; there are two prominent tubercles near the middle and several on the margins; the remaining segments are studded with numerous subconical tubercles; between the median plates there are small, transverse, secondary plates which may be divided by longitudinal fissures; penultimate segment oblong and distally concave.

The abdomen of the male is subtriangular behind the basal segment; that of the female rounded at the sides and tip and bent to one side.

Length, 200 mm.; breadth, 245 mm.; length of larger cheliped, 202 mm.; length of first ambulatory leg, 195 mm. Some specimens are widest between the tubercles at the postero-lateral angles, while others are widest between the tips of the last spines on the antero-lateral margin.

Sitka (Brandt); Vancouver's Is. (Bate); near the mouth of the Columbia River (White); Farallon Islands! Monterey!

Lopholithodes foraminatus *St.*

Echinocerus foraminatus STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 79. NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, p. 27, Pl. III. BOUVIER, Ann. Sci. Nat. (7), Tome XVIII, 1894, p. 184; *Ibid.* (8), Tome I, 1896, p. 27.

Carapace depressed, wider than long, the tubercles on the upper surface mostly small and subconical; median region elevated, furnished with a conical tubercle near the middle, and a group of smaller tubercles near the posterior end; cardiac region with a few subconical tubercles; an irregular line of tubercles extending from the median area to the postero-lateral angles of the carapace; the greater portion of the upper surface is covered with depressed, more or less papillose elevations. A smooth spot on either side of the median area as in *Mandtii.* Rostrum rather short, with the median spine much as in *Mandtii* and a cluster of spiny tubercles above the base. External to the orbits there are three spines in a nearly transverse line, behind which the antero-lateral margin is at first concave, then strongly convex; the spines on the convex portion of the margin are large and subconical; behind the convex part the margin is concave and devoid of spines; posterior margin of the carapace arcuated and studded with conical tubercles. Eye-stalks spinulous. Antennal acicle with strong spines on the margins but almost devoid of spines on the upper surface. Chelipeds very spiny; merus with the antero-internal angle produced and with a flattened, nearly semicircular area at the supero-distal angle; carpus with the inner lobe prominent, and with the outer edge excavated, forming a smooth, deep, rounded sinus which, when approximated to the shallower corresponding sinus on the anterior edge of the carpus of the first pair of ambulatory legs, forms a smooth, nearly circular hole; hands quite similar to those of *Mandtii.* Ambulatory legs and abdomen much as in the preceding species.

"Near San Francisco" (Stimpson); Farallon Islands! Victoria (Newcombe).

Easily recognized by the remarkable foramen between the chelipeds and the first ambulatory legs.

Genus **Lithodes** *Latr.*

Carapace broad, more or less depressed and spiny. Rostrum generally prominent and armed with spines. The large basal segment of the abdomen may be entire or composed of three or more plates; the three following segments are furnished with median, lateral, and marginal plates.

Lithodes Rathbuni *Benedict.*

Lithodes Rathbuni BENEDICT, Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 482.

Paralithodes ? Rathbuni BOUVIER, Ann. Sci. Nat. (8), Tome I, 1896, p. 23.

Carapace armed with four spines on the gastric area and four (two long and two short ones) on the cardiac; branchial region with six spines. Rostrum composed of five branches, the main stem sharply bent upward and deeply bifurcate; the lower spine projecting nearly horizontally. The right cheliped is rather slender; the carpus has more than twelve spines; palm with two rows of four spines each on the median, outer surface. Ambulatory legs slender and very spiny. Antennal acicle very long and slender.

Known from a single male specimen taken off San Simeon Bay, Calif., in 211 fathoms.

Lithodes californiensis *Benedict.*

Lithodes californiensis BENEDICT, Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 483.

Paralithodes ? californiensis BOUVIER, Ann. Sci. Nat. (8), Tome I, 1896, p. 23.

Very closely allied to *L. Rathbuni*, but having the spines on the carapace shorter and stouter and the rostrum simply bifid instead of divided into two, well-developed horns.

Known from two female specimens taken off Santa Cruz Island, Calif., in 155 fathoms.

There are several other species of *Lithodes* found further north on our coast, viz., *L. brevipes*, *camtschaticus*, *æquispinus*, and *Couesi*. *Panamensis* occurs on the west coast of Central America.

Legion PAGURINEA.

The Hermit Crabs.

Carapace elongated, generally membranaceous behind the cervical groove. Rostrum small. Abdomen generally long and unprotected by calcareous plates. First two pairs of ambulatory legs well developed, last two pairs small. Last abdominal segment furnished with a pair of appendages.

Species usually inhabiting the coiled shells of Molluscs.

Family PAGURIDÆ.

Antennular peduncle of moderate size, the first joint short and stout, second and third slender and cylindrical; both flagella small. The peduncle of the antenna is subcylindrical; acicle lanceolate. Gills phyllobranchiate. Abdomen soft, asymmetrical.

Genus **Pagurus** *Fabr.*

Front with a rostral projection. Ocular peduncles with the basal scale of moderate size and wide apart. Antennal acicle slender and elongated; flagellum long and naked. Chelipeds rarely subequal, the right usually the larger. Fourth pair of pereopods subchelate. First and second abdominal segments without genital appendages. Males without a protruded vas deferens.

Type.—Pagurus Bernhardus **(Linn.).**

It has been recently pointed out by Mr. J. E. Benedict[1] that the generic name *Eupagurus* will have to be superseded by the older name *Pagurus*. "I believe," says Mr. Benedict, "that the genus *Pagurus*, as now constituted, does not contain a single one of the original species placed in it by Fabricius; but be that as it may, a valid and therefore imperative reason for making the change lies in the fact that *Bernhardus* was designated as the type of *Pagurus* by Latreille in 1810[1]." The old genus *Pagurus* was divided by Brandt in his work on Crustacea in Middendorff's Siberische Reise[2] into several subordinate sections or subgenera, one of which containing *Bernhardus* and its allies was called *Eupagurus* or the true *Pagurus*. Brandt's subgenus *Eupagurus* was afterwards raised to the rank of a genus with *Bernhardus* as the typical species, thus depriving the older genus of its type. *Eupagurus* must, therefore, give way to the older name.

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[1] Ann. Nat. Hist. (6), Vol. XVIII, July, 1896, p. 99.

The species of the genus *Pagurus* are very numerous and often difficult to determine. The west coast of North America seems especially rich in these forms. The Albatross collections in museums of the University of California and the California Academy of Sciences have been of especial value to me in studying our species of this genus, and at the U. S. National Museum, through the kindness of Mr. Benedict, I have examined some species from this coast not previously met with. At one place or another I have seen all the species of *Pagurus* here described.

A few Atlantic species have been reported from this coast: *P. Kröyeri* from Puget Sound by Stimpson, and *Bernhardus* from the north Pacific by Brandt. The *Bernhardus* as Mr. Benedict suggests *(in litt.)* may be *aleuticus* or *alaskensis*.

The genus *Pagurus* is divided by Mr. Benedict into four subgenera as follows:

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[1] Consid. Gener. Crust., p. 421.

[2] Bd. II, Theil I, p. 105.

Subgenus **Eupagurus.**

Pagurus "with the large surface of the left hand horizontal. Species not inclined to be hairy."

Typical species, *P. Bernhardus* (LINN.).

P. aleuticus, *alaskensis* and *ochotensis* belong here. All are large species with the upper surface of the left hand triangular and the edges prominent.

Subgenus **Trigonocheirus.**

Pagurus "with the outer face of the left hand oblique and more or less triangular. In some cases it is flattened, in others concave, or very much swollen as in *hirsutiusculus*. The species are frequently very hairy."

Typical species *P. trigonocheirus* STIMPSON.

This group includes the greater number of the species here described, viz., *trigonocheirus*, *capillatus*, *Dalli*, *Brandti*, *Rathbuni*, *Tanneri*, *confragosus*, *Newcombei*, *Kennerlyi*, *hirsutiusculus*, *Samuelis*, *minimus*, *granosimanus*, and *Hemphillii*.

In many of the species the left hand is small and rounded, presenting no distinctly outlined upper face. In others the left hand is trigonous, with a well-defined, triangular face bounded by prominent edges. The first five species mentioned are very closely allied. In all three the chelipeds are very unequal, the carpus of the larger one oblong with the sides flattened and the upper surface furnished with short spines or spiny granules; the hand is oblong, evenly convex above, and armed like the carpus; the smaller hand has a prominent, triangular supero-external face. *Rathbuni* can be distinguished by the peculiar round pubescent patch on the upper side of the carpus. *Tanneri* and *confragosus* are distinguished from all the others by the ridge on the upper surface of the larger hand. *Newcombei* can be recognized by the bright red tips of the chelipeds and dactyls. *Kennerlyi* has the spines on the upper surface exceptionally long and slender. *Hirsutiusculus*, *granosimanus*, *Samuelis* and *Hemphillii* are small, littoral species. They are the forms most commonly met with along the shore at low tide. *Granosimanus* may readily be distinguished from the other three by its rounded, median, frontal projection and its broader left hand. *Hirsutiusculus* may be recognized by its strong pubescence, the short anterior portion of the carapace, and short eye-stalks.

Subgenus **Elassocheirus.**

Pagurus "with the left hand very small, in some cases almost rudimentary. The large hand is always wide or broadly ovate, excepting in *munitus* and *Gilli* where the carpus is exceedingly wide and the hand moderately so. Eye-scale semicylindrical, grading to triangular, sharp and pointed. Species not hairy; many of them smooth and glabrous."

Typical species, *P. tenuimanus* (DANA).

Besides the type the only species of this group in our limits are *munitus* and *californiensis*.

Subgenus **Labidocheirus.**

Pagurus "with the manus of the left cheliped cylindrical."

Typical species, *P. splendescens* (OWEN).

Pagurus alaskensis *(Benedict).*

Eupagurus alaskensis BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 2.

Anterior portion of the carapace a little wider than long and sparingly pubescent. Median tooth of the front triangular, acute, and produced considerably beyond the lateral ones, which are rounded, but furnished with a small spine. Ocular peduncles short, stout, constricted in the middle, and about one-half the length of the anterior portion of the carapace. Eye-scales subovate, with the apex blunt or subacute, the upper surface concave and the subterminal spine visible from above. Antennal acicle trigonous, reaching much beyond the tips of the ocular peduncles;

the upper surface flat, the inner margin spinulous and pubescent. Chelipeds spinulous, markedly unequal, and almost devoid of pubescence. Merus of the larger cheliped oblong, trigonous, the upper surface with a few transverse, granulated, or spinulous rugæ near the distal end; carpus with the inner and outer sides flattened, the upper surface convex and spinous, with a row of stout spines on the inner edge; hand oblong, slightly wider than the carpus; inner side flattened; upper surface moderately convex and covered with acute granulations; outer margin defined by a row of spiny granules; fingers armed within with tuberculous teeth. Merus of the smaller cheliped compressed; carpus with the inner side flattened, the supero-lateral surface convex and covered with spiny granules; outer margin raised; upper surface convex; upper internal margin armed with a row of strong spines, external to which is a similar row on the upper surface; hand oblong, flattened, and covered with sharp granules; outer margin raised; upper surface convex, the inner surface of the palm and dactyl flattened; dactyl much longer than the palm, the upper surface rounded. Ambulatory legs with the merus and propodus spinulous above, the dactyls long, curved, twisted, becoming thinner but not decreasing in width towards the tip, and pectinated below with slender, closely set, parallel spinules.

Concerning the color of this species Mr. Benedict says: "In alcoholic specimens the general color above is a light purple with iridescent reflections; below light tinged with reddish. A red streak runs around the prehensile edge of the thumbs and behind the dactyls to the inner margins of the hands. There is an oblong patch of red on the outer distal margins and on the upper surface of the merus joints of the cheliped. The lower outer surface of the carpal joints of ambulatory legs is pointed with red. The propodal joints and dactyls are longitudinally streaked with red. This species is very close to *Bernhardus* but is easily distinguished by its broader and shorter left hand, by the wide dactyls of the ambulatory legs, by the acicula, and by its pearly iridescence."

Alaska; off Washington in 31 to 38 fathoms (Benedict).

Pagurus aleuticus *(Benedict).*

Eupagurus aleuticus BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 3.

Closely allied to *alaskensis*. The teeth on the front are sharper, the lateral ones acute. Eye-peduncles stouter and over one-half the length of the anterior portion of the carapace. Antennal acicle similar to that of *alaskensis* but broader at the base and not projecting so far beyond the tips of the eye-peduncles. The chelipeds are very similar to those of *alaskensis* but the spines are more prominent; a prominent line of spiny granulations on the upper surface of the dactyl, which is represented only by an obtuse ridge in the preceding species. On the dactyl of the smaller hand there is an oblique, smooth surface visible from above which is not found in *alaskensis*, and the supero-external surface of the carpus of the smaller cheliped is much more flattened and the outer edge of the hand more elevated and more sharply spinose. The dactyls are similar in form to those of *alaskensis*, but are easily distinguished by the deep sulci on the upper side bounded by sharp, minutely spinulous edges.

Aleutian Is. (Benedict).

Pagurus ochotensis *(Brandt).*

Eupagurus ochotensis BRANDT, Middendorff's Sibirische Reise, Bd. II, Th. 1, 1851, p. 108. STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, p. 248.
Bernhardus armatus DANA, Proc. Acad. Nat. Sci. Phila., 1851, p. 269; Crust. U. S. Expl. Expd., Part I, 1852, p. 442, Pl. XXVII, fig. 2.
Eupagurus armatus STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 484. BATE in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 278. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471.

Anterior portion of the carapace wider than long; the three projections of the front about equally advanced. Ocular peduncles short and stout, but little over one-half the length of the anterior portion of the carapace. Eye-scales acute, with a prominent, subterminal tooth. Acicle slender, flattened above, and extending far beyond the eyes. Chelipeds spiny, the carpus of the larger one with the sides flat and sharply granulated, the upper surface evenly rounded and spiny, with a row of longer spines along the inner margin; hand oblong, evenly rounded above, and spiny like the carpus; dactyl with a row of spines on the outer edge and another row near the middle of the outer surface. Smaller cheliped reaching a little beyond the base of the dactyl of the larger one; carpus and hand spiny above, the inner edge of the palm somewhat raised and armed with two rows of spines, the outer spines being the shorter. The meral, carpal, and propodal joints of the ambulatory legs are spinous above; the dactyls are spinous, twisted, grooved on each side, and nearly as long as the two preceding joints. A large species.

Described from specimens (No. 14951) in the U. S. National Museum.

Puget Sound (Dana); Sitka! San Diego, Calif.!

Pagurus trigonocheirus *(St.)*

Eupagurus trigonocheirus STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, pp. 237 and 249. MURDOCH, Rep. Int. Polar Expd. to Pt. Barrow, Part IV, 1885, p. 138, Plate I, figs. 1, 1*a* and 1*b*. BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 1.

The three prominences of the front are subequal, the lateral ones ending in a minute spine. The anterior portion of the carapace is longer than wide and more or less pubescent; a tuft of hairs on the median projection of the front. Eye-stalks rather stout and much shorter than the width of the carapace. Eye-scales subovate, acute, more or less pubescent and not at all channeled above. Acicle rounded, pubescent, and reaching the tip of the ocular peduncle. Chelipeds pubescent; right cheliped with the ischium denticulated on the lower margin; merus trigonal, supero-lateral surface much rounded and scabrous; lower surface spinulous; the supero-distal margin spiny; carpus thick, oblong, the upper surface convex and covered with short spines; inner and outer surfaces flattened and less strongly spinose; hand oblong, slightly narrower than the distal end of the carpus; the upper surface convex and covered with short spines; inner margin obtuse; outer margin subacute, except near the base, and spinulous; lower surface spinulous near the margins; fingers shorter than the palm; dactyl narrower than the pollex, with a spinulous, subacute outer margin and a longitudinal row of short spinules on the upper surface. Smaller cheliped reaching beyond the carpus of the larger one; merus compressed, spinulous below; carpus compressed, distally widened, especially on the lower side, the upper margin spinulous; hand trigonous, the supero-lateral face wide, flattened, subspinulous or granular, the edges acute; the upper edge is the longer, with the posterior portion convex and spinulous, the spinules becoming smaller on the pollex; dactyl narrow and nearly smooth. Ambulatory legs scabrous or spinulous on the margins; the two small posterior pairs are smooth and strongly pubescent.

Length, 3 inches.

Arctic Ocean and Behring Sea (Stimpson); Alaska!

Pagurus capillatus *(Benedict).*

Eupagurus capillatus BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 8.

Anterior portion of the carapace a little longer than wide. Median frontal lobe broadly rounded. Ocular peduncles more than two-thirds as long as the anterior portion of the carapace, and slender. Acicle not reaching to the tip of the eye. Hand of larger cheliped twice as long as wide and rather sparsely set with sharp, stout spines. Hand of smaller cheliped narrow, slender, with the supero-external surface narrower than in *trigonocheirus*, and the edges not so strongly produced. Dactyls of the ambulatory legs slightly twisted.

Very near *pubescens* from the Atlantic. For an enumeration of the differences, see Benedict, l. c., p. 9.

Alaska; Washington in 40 fathoms (Benedict).

Pagurus Brandti *(Benedict).*

Eupagurus Brandti Benedict, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 9.

Median portion of the front triangular and produced scarcely beyond the lateral teeth. Eye-stalks rather stout. Acicles scarcely extending beyond the eyes. Hand of the larger cheliped twice as long as wide. Hand of the smaller cheliped as in *trigonocheirus*. Ambulatory legs almost entirely unarmed; dactyls slender, slightly twisted and longer than the propodi. Color of alcoholic specimens "everywhere reddish. Spines everywhere red or red pointed."

Aleutian Islands (Benedict); Captain's Harbor, Unalaska, 80 fathoms!

Pagurus Dalli *(Benedict).*

Eupagurus Dalli Benedict, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 9.

Very closely allied to *Brandti*. Median lobe of front triangular, acute, and produced further beyond the lateral teeth than in *Brandti*. Eye-peduncles more slender than in *Brandti* or *trigonocheirus*. Acicle reaching but little beyond the eyes. The carpus of the small cheliped is not so high, and the supero-external surface of the hand is not nearly so wide at the base as in the last two species. The dactyls of the ambulatory legs are long, more slender than in *Brandti*, and not twisted.

Aleutian Islands, Unalaska (Benedict); Iluliuk Harbor, 10 fathoms!

"This species," says Benedict, "is closely allied to *Kröyeri*, *trigonocheirus*, and *Dalli*. The small chelipeds of all have the triangular outer face, and in general the species resemble each other very much. With a large series of all I find substantial specific characters.

Brandti and *Dalli* are found together in a depth of from 15 to 85 fathoms in the Aleutian Island region. They grow to a length of three inches. They are separated at sight by a sharply defined band of white on the distal end of the merus joints of *Dalli*, which is entirely wanting in *Brandti*."

Pagurus Rathbuni *(Benedict)*.

Eupagurus Rathbuni BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 14.

Near *trigonocheirus*, but with the median projection of the front acute and projecting considerably beyond the lateral teeth. Eye-peduncles stout, not two-thirds as long as the anterior portion of the carapace. Eye-scales ovate, concave above, with a subterminal spine. Chelipeds resembling those of *trigonocheirus*; the hand of the larger one over twice as long as wide. Hand of the smaller cheliped much narrower than in *trigonocheirus*, the edges not nearly so prominent; fingers curved downwards. Ambulatory legs spinulous above; dactyls twisted, longer than the propodi, and nearly devoid of spinules with the exception of a few on the lower side near the tip.

Alaska.

This species is distinguished from all the other hermit crabs of the coast by the possession of a circular patch of fine hairs on the antero-internal angle of the upper surface of the carpus of the large cheliped. It is also distinguished from the four preceding species by its larger median frontal prominence.

Pagurus Tanneri *(Benedict)*.

Eupagurus Tanneri BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 10.

Anterior portion of the carapace as wide as long. Median frontal tooth triangular, much larger and projecting much further forward than the lateral teeth, which are broadly triangular, subacute, and furnished with a terminal spine. Ocular peduncles stout; corneæ dilated; scales ovate and furnished with a subterminal spine which is visible from above, the upper surface more or less concave. The outer spine of the second basal antennal joint reaches to, or beyond the middle of the fourth joint; acicle slender and exceeding the tips of the ocular peduncles. Chelipeds spinulous and pubescent; merus oblong, the supero-lateral surface rounded and scabrous, or spinulous; lower surface spinulous, and devoid of marked prominences; carpus thick, oblong, the inner and outer surfaces flat; upper surface convex, spinous, with the inner and outer edges defined by rows of spines; hand about as wide as the carpus and over twice as long as broad; on the upper surface behind the gap between the fingers is a longitudinal ridge, which is continued forward upon the pollex though diminishing in size; the ridge bifurcates behind, forming two lower, less marked ridges which diverge toward the posterior margin; on either side of this ridge the surface of the hand is depressed and less spiny than elsewhere; fingers flattened and bent downwards; a row of short spinules on the outer margin of the dactyl and a similar row near it on the upper surface. Merus of the smaller cheliped compressed, spinulous below; carpus compressed, but widened at the distal end of the lower side, having a rounded, spinulous process at the antero-external angle; upper edge with two series of spines; hand trigonous, supero-external face subtriangular, deeply concave; edges prominent, spinulous; a row of spinules extending from the proximal margin to the upper ridge, which it meets a short distance from the base; the surface below the upper edge is concave and limited below by a row of spinules; fingers curved downwards; dactyl slender, nearly smooth. Ambulatory legs subequal, spinulous above; dactyls slender, longer than the propodi, quite strongly twisted, and obsoletely spinulous.

Alaska; off Washington from 167 to 559 fathoms (Benedict).

Pagurus confragosus *(Benedict).*

Eupagurus confragosus Benedict, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 11.

Very near *Tanneri*. The median lobe of the front is acute but not so prominent as in that species. Ocular peduncles short, stout, distally widened, and not two-thirds the length of the anterior portion of the carapace. Chelipeds much like those of *Tanneri;* the larger hand is slightly wider, with the outer margin more curved; the triangular area between the two diverging ridges of the upper surface is wider, and the more prominent inner ridge is interrupted at about its posterior third, the two parts changing direction at this point; the elevated apex of the triangle where the ridges meet is not continued forward as a high crest as in *Tanneri*, but the ridge begins to descend immediately toward the pollex; fingers much flattened, but scarcely curved downward. Smaller hand scarcely distinguishable from that of *Tanneri*. Ambulatory legs subequal; dactyls slender, curved, twisted, nearly devoid of spinules.

"The two species," says Benedict, "are readily separated by the inner side of the raised triangle of the larger hand. In this species it cuts off the inner depression of the upper surface from the proximal margin of the palm, while in *Tanneri* this depression is allowed to reach the margin by a curvature of the ridge."

Alaska! off Washington and the mouth of the Columbia River in 68–178 fathoms (Benedict).

Pagurus Newcombei *(Benedict).*

Eupagurus Newcombei BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 17.

Anterior portion of the carapace longer than wide. Median frontal tooth short and obtuse; the lateral teeth broadly rounded and slightly prominent. Eye-stalks moderately slender and a little over one-half the length of the anterior portion of the carapace. Eye-scales subtriangular, slightly concave above, the subterminal spines prominent. Antennal peduncles longer than the eye-stalks; acicle nearly reaching the tip of the eye. Chelipeds very unequal; merus of the larger one stout; the outer surface is convex and nearly smooth, but there are some transverse spinulous rugæ near the supero-distal angle; two prominent tubercles on the lower side; carpus oblong, scarcely one-half longer than wide, and of nearly equal width throughout; outer surface flat; inner surface a little concave; upper surface evenly convex, thickly covered with spiny granules, and bordered on the inner side by a row of short spines, internal to which is a parallel row of smaller spines; hand no wider and scarcely longer than the carpus, and covered above with spiny granules; outer edge acute, especially on the pollex, and armed with short spines; fingers with minute, corneous tips; dactyl margined with spiny granules. Small cheliped pubescent; merus compressed, and more or less spinulous below; carpus armed with ten or twelve long, curved spines on the upper edge; outer surface with several spines on the upper side and spiny granules further down; hand longer than the carpus, with a triangular, spinulous, supero-external face; a sulcus on the posterior portion of the upper edge. The carpus and propodus of the ambulatory legs are armed above with spines, which are much smaller in the second pair, where they may be absent on the propodi; dactyls spinous below and about as long as the propodi.

Color in alcohol: chelipeds reddish, the tips of the fingers bright red. The ambulatory legs are spotted with red; the base of the dactyls and the distal end of the propodi are bright red.

British Columbia (Benedict); Sitka! Port Townsend!

Pagurus Kennerlyi *(St.)*.

Eupagurus Kennerlyi STIMPSON, Proc. Acad. Nat. Sci. Phila., 1864, p. 153. BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 19. WALKER, Trans. Liverpool, Biol. Soc., Vol. XII, 1898, p. 275.

Anterior portion of the carapace a little longer than wide. Median tooth of the front triangular, low, subacute; lateral teeth rounded, with a prominent submarginal spine making them appear acute. Eye-peduncles moderately slender and fully two-thirds the length of the anterior portion of the carapace; corneæ not large and scarcely dilated. Eye-scales subovate, dorsally concave, with a prominent subterminal spine, which is visible from above. Antennal peduncle exceeding the eyes; acicle rounded above and seldom reaching the tip of the eye. Chelipeds very unequal, pubescent, and spiny; merus nearly trihedral, the outer surface convex and nearly smooth; carpus short, distally widened; inner surface smooth, glossy, more or less concave; outer surface flattened, nearly smooth; upper face covered with scattered hairy prominences; inner edge furnished with seven or eight slender curved spines; a parallel row of three or four spines near the distal end; hand oblong, wider and much longer than the carpus; upper surface with seven to nine rows (including the marginal rows) of spines, a tuft of long hairs arising from the base of each spine; fingers corneous tipped; outer margin of the dactyl with a prominent row of short spines and a similar row on the upper surface. Merus of the left cheliped with the lower side spinulous; carpus compressed, with a double row of spines on the upper surface; hand with the supero-external surface widened at the base and thickly set with strong spines; upper edge with a smooth sulcus. Ambulatory legs pubescent, the upper sides devoid of spines except on the carpus of the anterior pair; dactyls not twisted, about equalling the propodi and armed below with slender spines.

Alaska (Benedict); Puget Sound (Stimpson)! Kadiak Is., lat. 55° 35′ 30″ N.; lon. 162° 31′ 45″ W.; 19 fathoms!

Pagurus hirsutiusculus *(Dana)*.

Bernhardus hirsutiusculus DANA, Proc. Acad. Nat. Sci. Phila., 1851, p. 269; Crust. U. S. Expl. Expd., Part 1, 1852, p. 443, Pl. XXVII, fig. 3.
Eupagurus hirsutiusculus STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 484; Proc. Acad. Nat. Sci. Phila., 1858, pp. 237 and 249.

Carapace and legs pubescent; anterior portion of the carapace a little wider than long; median tooth triangular and acute; lateral teeth obsolete. Ocular peduncles short, about one-half the length of the anterior portion of the carapace; corneæ scarcely dilated. Eye-scales oblong obtuse, concave on the upper side, with the subterminal spine visible from above. Antero-external process of the basal antennal joint short and stout, not reaching the middle of the fourth joint of the peduncle, and double pointed; acicle rounded, pubescent on the inner side, and not reaching the middle of the last joint of the peduncle. Chelipeds very unequal; merus of the larger one trigonal, with the angles rounded and the surfaces convex and marked with small, transverse, granulated, pubescent rugæ; carpus oblong, distally widened, the sides rounded and the upper surface very convex; surface covered with pubescent, granulated rugæ similar to those on the merus, which become broken up, in many places, into separate granules; hand oblong, nearly twice as long as wide, the upper surface evenly convex and granulated; fingers short and stout, the dactyl with a row of granules on the upper side parallel to the outer edge. Smaller cheliped with the merus and carpus compressed and granulo-scabrous; hand small, narrow, with the sides rounded and having no prominent angles; palm more or less inflated, with often a trace of a groove near the proximal end of the upper surface; surface of the hand granulated; fingers pubescent with corneous edges. Ambulatory legs granulo-scabrous, but not spinous, except on the lower side of the dactyls and the distal end of the propodi; dactyls nearly straight, almost as long as the propodi, and not twisted.

Alaska! Behring Is.! Puget Sound; Oregon; northern to southern California! Common on the shore at low tide.

Pagurus Samuelis *(Stimpson).*

Eupagurus Samuelis Stimpson, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 86; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 482; Proc. Acad Nat. Sci. Phila., 1858, p. 250; Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 90, Pl. I, fig. 8. Ortmann, Zool. Jahrb. Abth. f. Syst., Bd. VI, 1892, p. 301, Pl. XII, fig. 12.

Closely allied to *hirsutiusculus*. Body and legs quite strongly pubescent. Anterior portion of the carapace considerably longer than wide. Median tooth of the front quite prominent and sharp; lateral teeth represented only by a slight convexity in the margin. Ocular peduncles moderately stout, somewhat constricted in the middle, and about one-half as long as the anterior portion of the carapace. Ocular scales subovate and dorsally concave, with the subterminal spine visible from above. Antennal peduncle exceeding the eyes by fully one-half the length of the last joint; acicle rounded above, pubescent on the inner margin, not reaching the middle of the last joint of the peduncle, but nearly reaching the tip of the eye-stalk. Chelipeds very unequal, the larger one elongated, granulated, nearly devoid of pubescence, but furnished with minute setæ which arise from the base of the granules; merus compressed, the angles rounded, length about one-half greater than the height; outer surface convex and more or less granulo-rugose toward the distal end; carpus in the adult a little over one-half longer than wide, the upper surface evenly convex and rounded off to the sides, the outer of which is granulated and more or less flattened; inner side somewhat more strongly granulated and slightly concave; on the posterior portion of the carpus there are several transverse, granulated rugæ which become gradually replaced anteriorly by isolated, rounded granules; hand oblong (but not twice as long as wide), broader than the carpus, becoming more elongated with age; upper surface evenly convex and granulated like the carpus, the granules becoming longer on the pollex; outer margin acute, granulo-denticulate, the granules becoming less sharp with age; fingers shorter than the palm; outer margin of the dactyl granulo-denticulate; a granulated line on the upper surface parallel to the margin; tips of the fingers corneous in young, but calcareous in old specimens. Smaller cheliped pubescent, not reaching the base of the dactyl in adults, and often scarcely reaching the base of the hand; merus spinulous below; carpus compressed, the upper edge armed with nine or ten sharp spines external to which is a parallel row of smaller spines; the granulations on the lower surface become more or less spiny towards the anterior margin; hand granulated, narrow, oblong, not shorter than the merus; palm rounded, having no prominent ridges or angles; fingers corneous tipped. Ambulatory legs pubescent, the propodi granulo-spinose above; dactyls rather stout, spinous below, and markedly shorter than the propodi. The dactyls are of a bluish color with a longitudinal reddish stripe on the sides; distal end of the propodi bluish.

Patrick's Point! Mendocino County! Pescadero! Monterey (St.)! Santa Catalina Is.! San Pedro! San Diego! Japan (Stimpson, Ortmann).

I very strongly doubt that the *E. Samuelis* reported from Japan by Stimpson and Ortmann is the same as our California species.

Pagurus minimus, sp. nov.

Anterior part of the carapace about as wide as long; median projection of the front triangular, acute, the lateral ones rounded. Eye-scales pointed, with a very prominent subterminal spine. Ocular peduncles stout, cylindrical, a little flattened distally, and about two-thirds the length of the anterior portion of the carapace, reaching about the middle of the last joint of the antennal peduncle. Acicle short, slender, nearly reaching the tip of the corneæ, but not reaching the middle of the last joint of the peduncle. Chelipeds pubescent; merus of the larger one compressed, the angles rounded; carpus one-half longer than broad, distally widened, the upper surface rounded, not sharply marked off from the lateral faces, and armed with short spines which are inclined forwards; inner face convex, but less so than the outer, which is evenly rounded; hand oblong, widening distally to a short distance beyond the base of the dactyl; the base of the hand is armed with spines, which are inclined forwards like those of the carpus, and is strongly convex longitudinally, giving the hand the appearance of being bent downwards; pollex broad, the outer edge evenly rounded, sharp, upturned, and armed with anteriorly directed spines, the upper surface smooth and concave; dactyl broad, widest a little beyond its articulation, the outer margin sharp, spiny, evenly curved, the upper surface nearly smooth and concave; inner margin of both fingers furnished with large, white, tubercular teeth; lower side of the hand evenly convex from side to side, the distal two-thirds longitudinally nearly straight, tapering evenly to the tip of the pollex. Hand of small cheliped narrow, rounded, the upper face oblique; fingers longer than the palm. Ambulatory legs rather slender and pubescent; dactyls slender, curved, tapering from the base, spiny below, and longer than the propodi.

General color reddish, with spots of darker red; larger cheliped a darker red than the rest of the body, especially at the distal end; ocular peduncles with a median, transverse, light-colored band.

Length, three-eighths of an inch.

Described from a single female specimen dredged in 30 fathoms off San Diego, February 11, 1899. The specimen carried numerous pale green eggs.

This species is best distinguished by the character of the larger hand, which is convex at the narrow base, both longitudinally and transversely, while the distal portion is nearly smooth, longitudinally straight, but transversely concave. Collection University of California.

Pagurus granosimanus *(St.)*

Eupagurus granosimanus STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 90. SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 211.

Anterior portion of the carapace a little longer than wide. Median tooth of the front broad and rounded; lateral teeth represented only by slight convexities of the margin. Ocular peduncles moderately stout, and about two-thirds the length of the anterior portion of the carapace; corneæ transverse and scarcely dilated. Eye-scales subovate, more or less concave on the dorsal surface, the subterminal spine visible from above. Antennal acicle reaching but little beyond the eyes, exceeding them by much less than half the length of the terminal joint; acicle not nearly reaching the corneæ or the middle of the last joint of the peduncle. Chelipeds very unequal, the right one elongated in adults, devoid of pubescence, and strongly granulated; merus a little less than one-half longer than high, the anterior portion of both lower edges denticulated; lower surface furnished with two rounded tubercles; outer surface convex and roughened as in *Samuelis;* carpus oblong, more than one-half longer than wide, but not twice as long; upper surface evenly convex and strongly granulated; sides flattened; upper edges rounded; hand oblong, nearly twice as long as wide, slightly wider and about one-sixth longer than the carpus, the upper surface evenly convex and granulated, the granules becoming larger on the pollex; outer margin acute, especially on the pollex, and granulo-dentate; dactyl nearly as long as the palm, the outer edge acute, granulo-dentate; tips of the fingers calcareous; smaller cheliped nearly devoid of pubescence; merus compressed; carpus rather stout, the upper margin sharp and armed with 5–7 spines; the upper part of the external surface is more or less spinulous, the lower portion granulo-rugose; hand oblong, wider than the carpus, and longer than the carpus or merus; the supero-external surface rather wide at the base and strongly granulated; supero-internal edge marked proximally by a ridge, external to which is usually a slight groove. Ambulatory legs spinous on the upper edges; dactyls spinous below and armed with smaller spines above, shorter than the propodi, not twisted, and armed with long, corneous claws.

Color in alcohol reddish; legs dark and marked with small bluish spots behind the small tufts of setæ; granules bluish.

Monterey (Stimpson)! San Pedro! San Diego! Pescadero! Patrick's Point, Humboldt County, Calif.! Puget Sound!

Pagurus Hemphillii *(Benedict).*

Eupagurus Hemphillii BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 16.

Closely allied to *granosimanus* and *Samuelis.* Carapace glossy, the anterior portion much longer than broad. Median tooth acute, the lateral teeth represented by a convexity in the margin. Eye-stalks rather slender and about two-thirds the length of the anterior portion of the carapace. Eye-scales subovate, more or less concave above, and subacute, the subterminal spine visible from above. The antennal peduncle somewhat exceeds the eye-stalk but not by one-half the length of the last joint; acicle small, much shorter than the eye-stalk, not reaching the posterior third of the last joint of the peduncle. Chelipeds markedly unequal; merus strongly compressed, the outer surface quadralateral, nearly smooth, but marked more or less as in *Samuelis;* anterior portion of both lower margins denticulated; a small tubercle at the lower posterior angle; carpus oblong, deep, twice as long as wide, the sides flattened, the upper surface convex, thickly granulated, with the edges rounded, there being no definite lateral margins; hand oblong, no wider than the carpus at the base, but widening distally, being broadest near the base of the dactyl; upper surface evenly convex and granulated like the carpus; outer edge acute; dactyl shorter than the palm. Merus of the left cheliped with the outer part of the lower margin spinulous; carpus with nine or ten spines on the sharp upper edge, external to which is a parallel row of much smaller spinules; hand much compressed, scarcely wider than the carpus, its broad, outer face nearly parallel with the inner one; a groove on the upper surface extending from the posterior margin nearly to the dactyl and margined on either side by spiny granules. Ambulatory legs slender, much compressed, the carpus and propodus of the anterior pair (and especially the right member) spinulous on the upper surface; dactyls spinulous below, scarcely as long as the propodi and not twisted.

Color in alcohol, bright red, the tips of the dactyls light colored.

"California" (Benedict); Humboldt County, Calif.?

Pagurus tenuimanus *(Dana).*

Bernhardus tenuimanus Dana, Proc. Acad. Nat. Sci. Phila., 1851, p. 269; Crust. U. S. Expl. Expd., Part I, 1852, p. 447, Pl. XXVII, fig. 7.

Eupagurus tenuimanus Stimpson, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 483; Proc. Acad. Nat. Sci. Phila., 1858, p. 237. Smith, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 211. Benedict, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 1. Walker, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 274.

Carapace smooth, naked. Median process but little more prominent than the lateral teeth which end in a minute spine. Eye-scales narrowly oblong, subacute, channeled above, and having a minute subterminal spine not visible from above. First three joints of the antennal peduncle armed as in *munitus;* acicle rounded, the inner side pubescent, the tip reaching as far as, or a little beyond the ocular peduncles; flagellum long. Chelipeds very unequal; merus of the larger cheliped short, trigonous, with the sides convex, the length and breadth subequal; surface more or less tuberculated, especially near the supero-distal angle, which is furnished with several marginal spines; extero-distal angle with a few spines; carpus stout, a little longer than wide, the upper surface strongly convex and thickly covered with small, sharp tubercles; inner edge spinous; hand very wide and strongly flattened, with the edges produced into prominent, thin expansions, which make the hand much wider than the carpus; both surfaces thickly covered with small tubercles; inner edge of the hand convex, denticulated, and curved downward in the middle; fingers strongly compressed and hollowed out above, both sides minutely tuberculated or granulated. Left cheliped with the merus flattened, denticulated on the upper margin and at the infero-distal angle; carpus compressed, upper surface granulated or tuberculated, the inner edge acute and spinous; hand flattened, similar in shape to that of *munitus*, but the raised margins are denticulated; upper surface granulated or minutely tuberculated, the proximal margin overlapped by, instead of overlapping, the distal margin of the carpus; lower surface smooth; fingers more or less pubescent. Ambulatory legs nearly naked, and marked with red spots; upper margins spinulous; dactyls slightly twisted, considerably longer than the propodi, the margins and anterior surface spinulous; sides of the preceding joints smooth and glossy.

Length of large cheliped, 81 mm.; merus, 19 mm.; width of same, 16 mm.; carpus, 26 mm.; width of same, 24.5 mm.; hand, 34 mm., greatest width of same, 29 mm.; length of smaller cheliped, 51 mm.

Puget Sound (Dana); Kadiak Is., Alaska!

Pagurus californiensis *(Benedict)*.

Eupagurus californiensis Benedict, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 21. Faxon, Mem. Mus. Comp. Zool. Harvard College, Vol. XVIII, 1895, p. 55, Pl. XI, fig. 2–2*e*.

Median tooth of the front low and scarcely in advance of the broadly triangular lateral teeth. Ocular peduncles moderately stout and about three-fourths as long as the anterior portion of the carapace, which is nearly as wide as long. Eye-scales oblong, subacute, deeply channeled above, and curved downward, the subterminal spine small. Acicle rounded, pubescent on the inner margin, and not reaching the tips of the ocular peduncles. Chelipeds of exceptionally unequal size; larger cheliped glossy; merus trigonous, the surfaces convex and nearly smooth, but slightly roughened with scattered, minute prominences; carpus much widened at its distal end where its breadth about equals its length; upper surface convex and furnished with scattered, depressed granulations; outer margin raised and finely granulated; inner margin prominent and armed with several short, unequal spines; outer surface more or less flattened; inner surface oblique and slightly concave; hand flattened, much wider than the carpus, and nearly as broad as long; upper surface evenly convex and covered with sharp granulations of unequal size; outer margin acute, denticulated, and evenly curved from the tip of the pollex to the base; inner margin produced, acute, more strongly denticulated than the outer, and ending in a prominent angle some distance from the base of the dactyl; fingers compressed; pollex very wide and furnished with several large granulations; dactyl with the upper margin sharply granulated and furnished with a granular line on the surface, between which and the outer margin the surface is deeply concave. Merus of the smaller cheliped compressed, narrow, and smooth, except on the lower side, which is spinulous toward the distal end; carpus compressed, armed above with two rows of spines, the included surface being slightly concave; hand small, oblong, with no prominent angles, a little longer than the carpus, but not exceeding the merus. Ambulatory legs glossy, nearly smooth; a spine at the supero-distal angle of the carpus projecting over the propodus; dactyls thin, pubescent, not twisted, and spinulous below, exceeding the length of the propodi.

Color of alcoholic specimens near orange; the ambulatory legs crossed by bands of a lighter color. There is a band of lighter color near the middle of the ocular peduncles.

California (Benedict); Santa Catalina Island! Dredged in the harbor of Avalon.

Pagurus munitus *(Benedict).*

Eupagurus munitus BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 19.

Carapace smooth, nearly naked, the anterior margin with three nearly equal teeth. Eye-scales oblong, channeled above. First joint of the antennal peduncle with a spine or tooth at the interior antero-inferior angle; second joint with a spine at the antero-internal angle, the infero-distal produced forward into a prominent spine which is generally double pointed; third joint with a spine at the apex; acicle rounded, pubescent on the inner side, and about reaching the tips of the ocular peduncles. Chelipeds very unequal, merus of the right cheliped short, trigonous; carpus broader than long, the margins produced into two large, thin, wing-like expansions and curved so that the inner surface is concave; hand smooth, much narrower than the distal end of the carpus, and about twice as long as wide, the edges subparallel; outer edge slightly concave; fingers punctate, shorter than the palm. In the smaller cheliped the carpus is elongated and compressed, the upper margin spiny; hand oblong, smooth, much flattened, the acute edges upturned, making the upper surface markedly concave; proximal margin acute and overlapping the distal end of the carpus; fingers smooth, more or less pubescent below, the dactyl provided with a crest which is a continuation of the elevated margin of the hand; the opposite margin is continued as a similar crest upon the pollex. Ambulatory legs slender, glossy, nearly naked, the upper margins of the last three joints more or less spinulous; dactyls slightly longer than the propodi.

Alaska!

Genus **Paguristes** *Dana.*

Front with a distinct rostral projection. Ocular peduncles long and slender, the scales of moderate size. Antennules long. Antennal acicle robust, flagellum ciliated. Chelipeds equal or subequal, the fingers moving in a horizontal plane. Fourth pair of pereopods not chelate. The first two abdominal segments in the male and the first segment in the female bear sexual appendages.

Type.—P. longirostris DANA.

Paguristes turgidus *(St.).*

Eupagurus turgidus STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 86.

Clibanarius turgidus STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 484, Pl. XXI, fig. 1. Bate in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 278. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471.

Paguristes turgidus STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, p. 236; Ann. N. Y. Lyc. Nat. Hist., Vol. VII, 1860, p. 86. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 211. WALKER, Trans. Liverpool, Biol. Soc., Vol. XII, 1898, p. 275.

Carapace pubescent, the anterior portion longer than wide. Front tridentate, the median tooth much the largest. Ocular peduncles over one-third the length of the anterior portion of the carapace. Antennal acicle armed with several dark-tipped spines on the inner margin; flagellum short. Chelipeds hairy above, the upper surface covered with dark-tipped spines; fingers corneous tipped. Ambulatory legs hairy, the dactyls a little longer than the propodi. Attains a length of about three inches.

Puget Sound (Stimpson); Vancouver's Is. (Smith); Farallon Islands! Santa Catalina Is.!

Paguristes parvus, sp. nov.

Rostrum long, narrow and acute. Ocular scales cut into three spines. Ocular peduncles pubescent, enlarged at the base, and exceeding the peduncle of the antennæ Acicle pubescent, reaching nearly to the tip of the peduncle, and having the outer margin armed with short spines; second joint of the peduncle produced, external to the acicle, into a process which is cut into three spines. Legs pubescent. Chelipeds equal, the merus nearly smooth; carpus with a flattened, subtriangular upper surface, the inner and outer margins of which are armed with three or four short, stout spines; hands with the upper surface coarsely granulated; the short inner margin armed with three short, stout spines; a longitudinal intumescence on the upper surface upon which are two rows of small tubercles; fingers excavated within and having black, corneous tips. The upper margins of the carpi and propodi of the ambulatory legs are spinulous; dactyls scabrous, slender, nearly straight, and longer than the propodi. Length one-half inch.

Three specimens taken at White's Point near San Pedro, Calif., July, 1895.

Collection University of California.

Paguristes Bakeri, sp. nov.

Carapace hairy, the anterior portion nearly as wide as long, eroded in front and towards the sides, and having a few short spinules near the antero-lateral margins; front with three, subequal, triangular teeth. Ocular peduncles slender, cylindrical, two-thirds the length of the anterior portion of the carapace, and having a line of hairs on the upper side. Ocular scales armed with several marginal spines which become larger towards the tip. Peduncle of the antennæ nearly three-fourths the length of the eye-stalk; second basal joint with a spine at the antero-internal angle; the antero-external angle produced forward as a large, triangular, acute process which is armed with a few short spines on the outer margin. Acicle rather small, awl-shaped, hairy, reaching a little beyond the middle of the last joint of the peduncle, the inner margin armed with spines and the outer margin furnished near the tip with two spines which point obliquely upwards. Chelipeds equal; merus trigonous, the upper anterior end hirsute and spiny and the two lower margins armed with short spines; carpus short, hirsute and spiny above, the inner margin of the upper side armed with about six spines which increase in size anteriorly; outer face small, hard portion of the lower side reduced to a narrow, transverse bar, inner face flattened, with a concavity on its lower side, and armed with a few spines above and anteriorly; hands short and broad, widest across the base of the pollex, the upper surface flattened, hairy, armed with numerous spines, inner edge straight, the outer very strongly curved, inner faces flattened and armed with small spines, four spines on the inner margin behind the base of the dactyl; pollex very broad at base;

lower surface of hand tumid below base of pollex and armed with short spines; an angle of 90° between its upper and inner faces. Ambulatory legs hairy; carpus of the anterior pair spiny above; propodus armed below with short spinules and above with seven or eight rather strong spines; dactyls flattened, much longer than the propodi, both margins closely set with spines; second pair much less spiny than the first.

There is a pair of very small, simple, two-jointed appendages on the first abdominal segment in the female, but the succeeding four segments have an appendage only on the left side; of these the first three (those on the second, third, and fourth segments) are well-developed and biramous, but the appendage on the fifth segment is smaller and reduced to a single branch. In the male the pair of appendages on the first abdominal segment is larger than in the female and the inner faces are channeled; the second segment has a pair of appendages, and the third, fourth and fifth segments have a uniramous appendage only on the left side.

General color dark reddish; legs more or less colored with blue.

Length of female 2.5 in.; of males 4.5 in. and 5 in.

Described from three specimens from San Diego, Calif.: one a female loaned by the San Diego Natural History Society, and two large males. For the opportunity of examining the latter I am indebted to Dr. Fred Baker of San Diego.

This species is allied to *P. fecundus* Faxon, but is distinguished by having a less prominent rostrum, much longer antennal flagellum, shorter dactyls on the second and third pereopods, and small but well-marked spines instead of "obscure teeth," on the terminal lobes of the telson.

Holopagurus, gen. nov.

Rostrum not prominent. Ocular peduncles moderately long and slender; basal scales close together. Antennal acicle rather short; flagellum hairy. Left cheliped larger than the right; fingers of both hands moving horizontally, their inner margins not excavated. Fourth pair of legs more or less chelate. First abdominal segment of the male devoid of appendages; second, third and fourth segments with an appendage only on the left side. Telson entire.

Type.—H. pilosus.

Holopagurus pilosus, sp. nov.

Anterior portion of the carapace slightly wider than long, eroded at the front and sides, and having a few short spinules near the antero-lateral margin. Frontal margin transverse, rostral projection represented by a small prominence which does not exceed the lateral ones. Ocular peduncles cylindrical, rather slender, and about two-thirds the length of the anterior portion of the carapace; corneæ not dilated; basal scales very wide at base, their inner sides produced forwards into a subacute, triangular lobe. Antennular peduncle about equalling the eye-stalks. Peduncle of the antennæ shorter than the eye-stalks, the second joint with a short spine at the antero-external angle but none at the antero-internal angle; last joint of the peduncle short, less than twice as long as wide; acicle straight, ciliated, evenly tapering to an acute tip, convex and roughened above, and not reaching the tip of the peduncle; flagellum shorter than the carapace and thickly set below with long hairs. Chelipeds of similar form, furnished with long hairs and short spines; merus trigonous, the lower side flattened, the upper edge sharp; carpus armed with short, scattered spines on the upper surface which is convex, rounding off insensibly to the small outer face; inner face flattened and separated from the upper surface by a rather sharp edge which is armed with sharp spines and turns outward near the base more sharply on the left cheliped than on the right; hands horizontally flattened, the upper surface gently convex and covered with scattered spines which are larger and more thickly set near the rounded margins; the larger hand is widest across the base of the fingers, beyond which it is quite abruptly contracted; the pollex is rather narrow a short distance beyond the base, its inner and outer margins rounded, the tip corneous; dactyl subconical, the tip corneous and strongly curved, its surface thickly set, like the pollex, with short, corneous spines. The smaller hand is relatively narrower than the larger one, the inner and outer faces parallel; pollex not so much contracted beyond the base as in the larger hand, its outer margin evenly convex near the base and not slightly concave like that of its fellow. Ambulatory legs hairy and armed with spines on the upper sides of the merus, carpus and propodus; propodi subcylindrical, nearly smooth below; dactyls long, gently curved, flattened towards the tip, subcylindrical at the base, about twice the length of the upper side of the propodi, strongly twisted, and armed only with very short, corneous spinules. Dactyl of the fourth pair of legs extending for about one-third its length beyond the propodus. Coxæ of the last pair of legs separated by an oblong process of the sternum on the posterior side of which is a sharp, median groove. Abdominal appendages long and hairy.

The posterior portion of the carapace is more or less calcified, especially over the cardiac area, and the branchial regions are reticulated with membranous lines.

General color yellowish white; the antennæ are blue and the anterior portion of the carapace has more or less of the same coloration; a peculiar reddish coloration occurs on different parts of the body, notably on either side of the cardiac area of the carapace.

Length four inches; large cheliped three-eighths of an inch longer than the smaller one.

One large male specimen and several small ones dredged in about 25 fathoms off San Diego, Calif. Collection University of California.

Family PARAPAGURIDÆ.

Similar to the Paguridæ but having trichobranchiæ, instead of phyllobranchiæ. Deep sea forms.

Genus **Parapagurus** *Smith.*

Resembles *Pagurus*. Third maxillipeds widely separated at the base. Chelipeds very unequal. Sternum between the first and second pereopods narrow. Eleven pairs of branchiæ, two at the base of the maxillipeds and each of the first three pereopods, and three at the base of the fourth. Well developed and symmetrical pairs of appendages on the first and second abdominal segments in the male.

Type.—*P. pilosimanus* SMITH.

Parapagurus Mertensii *(Brandt).*

Pagurus Mertensii BRANDT, Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 112.

Eupagurus Mertensii STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 483; Proc. Acad. Nat. Sci. Phila., 1858, p. 237. BENEDICT, Proc. U. S. Nat. Mus., Vol. XV, 1892, p. 2.

Anterior portion of the carapace sparsely hairy and about as wide as long. Median frontal tooth prominent, acute, the lateral teeth small. Ocular scales ovate, acute, concave above. Eye-stalks short, about one-half the length of the anterior portion of the carapace. Acicle slender, rounded, sparsely ciliated, curved downwards, much exceeding the eye-stalks, but not reaching the tip of the antennal peduncle. Chelipeds pubescent, spiny, very unequal; right cheliped very large; merus armed with a row of short spines on the inner and outer margins of the lower side; carpus long, the inner and outer margins spiny, and the convex upper surface armed with two rows of short spines; outer face more or less flattened; lower side bulging and armed with a few short spines; hand long, narrow, dorso-ventrally flattened, and bent inward at a slight angle to the carpus; the rounded upper surface furnished with small, subserially arranged granules which become more prominent on the fingers; inner and outer margins sharp, granulo-denticulate and parallel; lower surface of the palm with a broad, shallow concavity which extends nearly to the dactyl. Left cheliped slender; merus spiny below; carpus subcylindrical, with three rows of spines on the upper surface; hand narrow, much longer than the carpus; palm very short; fingers long, narrow, and curved downwards. Ambulatory legs long, compressed, and very slender; dactyls exceedingly long and slender and armed below with numerous spines.

Described from a single female specimen obtained from the U. S. National Museum from Mr. Benedict, who pointed out that it was not a true *Pagurus* but belonged among the trichobranchiate forms.

Northern California, Nitkasund, Kadiak Is., Atcha, Kamtschatka (Brandt); lon. 33° 55′ 30″ N.; lat. 119° 53′ 30″ W.; 19 fathoms!

This species affords one of those curious cases of commensalism with colonies of hydroids sometimes found among deep sea pagurids. The colony of hydroids covering the shell in which the crab lives forms a membranous growth which extends beyond the boundary of the shell and, in course of time, according to Mr. Benedict, causes the shell to disappear, leaving its inhabitant with a membranous, instead of a calcareous domicile. In the specimen which I have, the covering is partly formed by the tip of a broken shell, but mainly by an extension of the membranous growth formed by the colony of hydroids. This arrangement certainly affords the crab the advantage of allowing it to grow, without its having to undergo the troublesome experience of changing its lodgings.

Subtribe THALASSINIDEA.

Carapace short, compressed, and marked with two longitudinal sutures. Rostrum small or wanting. Both pairs of antennæ elongated and furnished with long peduncles, those of the outer pair five-jointed and usually devoid of an acicle. First pereopods more or less chelate; second pair often chelate; third pair always simple. Last segment of the thorax movable. Abdomen long, the segments not overlapping, the side plates feebly developed. Tail-fin well developed. Branchiæ variable.

Family CALLIANASSIDÆ.

Carapace strongly compressed. Rostrum flattened. Eyes small. First pair of chelipeds generally unequal; second pair with or without chelæ. Side plates of the abdomen absent. Telson and uropods broad and devoid of cross furrows. Burrowing crustaceans with soft, elongated bodies.

Genus **Upogebia** *Leach.*

Rostrum short and tridentate. Eyes small, with cylindrical peduncles. No antennal scale. External maxillipeds pediform. First thoracic legs subequal and subchelate, the pollex small; the remaining pairs not chelate. Abdomen long, with subquadrate joints; pleopods broad, the second pair similar to the others; uropods broad and foliaceous; telson broad, subquadrate, foliaceous. Podobranchiæ and mastigobranchiæ wanting.

Type.—U. stellata **(MONTAGU).**

Upogebia pugettensis *(Dana).*

Gebia pugettensis DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 19; Crust. U. S. Expl. Expd., Part I, 1852, p. 510, Pl. XXXII, fig. 1. STIMPSON, Journ. Bost. Soc Nat. Hist., Vol. VI, 1857, p. 488, Pl. XXI, fig. 2. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 299.
Gebia californica STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88.

Upper portion of the carapace in front of the cervical groove flattened, scabrous, and hairy, and marked with three longitudinal grooves, the median groove being the shortest; front with the median tooth large, horizontal, triangular, the lateral teeth short. A minute marginal tooth or spine generally present a short distance below the lateral teeth. Anterolateral and postero-lateral angles rounded. Eye-stalks short, reaching very little further forward than the lateral teeth of the front. Antennules less

than one-half the length of the antennæ, the flagella subequal. Peduncle of the antennæ exceeding that of the antennules; flagellum ciliated and longer than the carapace. Chelipeds equal; merus spinulous and hairy below; carpus with the upper and lower edges spinulous, and having a spine at the antero-internal angle and another spine a short distance below it; hand with two parallel, scabrous, hairy lines on the upper edge and a transverse granulated line at the proximal end of the inner surface; a line of hairs on the outer surface which is continued obliquely across the carpus; lower side of the palm scabrous and hairy; pollex short, bent downwards, and having a tooth near the middle; dactyl obliquely compressed, incurved, acute, projecting, when closed, far beyond the tip of the pollex. Uropods short, the inner ramus distally rounded, truncated, the outer rounded. Telson entire, rectangular, wider than long.

Length, 112 mm.

Queen Charlotte Is. (Smith); Vancouver's Is. (Bate); Puget Sound (Dana); Bodega Bay! San Francisco Bay! Monterey! Santa Catalina Is.! San Pedro! San Quentin Bay, Lower California (Lockington).

This species can generally be found wherever muddy beaches occur. It inhabits holes of one or more feet in depth, many of which are left uncovered at low tide, when the creatures can easily be dug out. Specimens are often taken, however, at a depth of several fathoms.

There is a peculiar parasitic crustacean, *Phyllodurus abdominalis* St., that is often found upon this species, being usually attached to the base of the abdominal appendages. Sometimes also a small bivalve mollusc, *Pythina rugifera*, is found attached to this crustacean by its byssus.

The tooth on the pollex is sometimes absent, as it was in the specimen described by Dana. "This tooth," says Stimpson, "is a prominent character in all the very numerous specimens in the Smithsonian Museum, but it is obsolete in the specimen described by Dana, although actual comparison shows them to be the same." In some small specimens from Catalina Island the small marginal spine beneath the lateral teeth of the front was absent, although they agreed with specimens from northern California in every other essential feature.

Genus **Callianassa** *Leach.*

Rostrum absent or reduced to a small point. Eye-peduncles flattened; cornea median, small or absent. Antennular flagella never shorter than the preceding joint. No antennal scale. External maxillipeds operculiform. First pair of pereopods very unequal and furnished with well-developed chelæ; second pair small and chelate; third pair with the penultimate joint broadly expanded; fifth pair subchelate. Second pair of abdominal appendages in the female slender, the succeeding ones broad, foliaceous, and fringed with ciliated hairs. Caudal appendages wide. Gills with flattened filaments.

In this genus, according to Bate, only arthrobranchiæ are present, with the exception of a rudimentary mastigobranchia on the third maxilliped.

Callianassa californiensis *Dana.*

Callianassa californiensis DANA, Proc. Acad. Nat. Sci. Phila., 1854, p. 175. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 489, Pl. XXI, fig. 4. A. MILNE-EDWARDS, Nouv. Archiv. Hist. Nat. Paris, Tome VI, 1870, p. 82. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 301.

Callianassa occidentalis STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88.

Front very short and rounded, with a small, triangular tooth on either side between the bases of the ocular peduncles and the antennæ. Ocular peduncles subtriangular, approximated at the bases, but diverging towards the acute tips which are somewhat upturned. Antennulary flagella subequal. Antennæ from one-half to two-thirds the length of the body, the peduncle nearly equalling that of the antennules. Chelipeds in the adult male with one arm enormously developed; ischium of the larger cheliped slender, compressed, incurved, distally widened, and finely denticulated on the acute lower margin; merus about as long as the ischium (generally a trifle longer) but stout, curved, smooth, almost naked except on the ciliated margins, and furnished with a prominent lobe at its infero-proximal angle; carpus very wide, a little longer than the merus, the outer surface smooth. naked, glossy, and evenly convex as if forming a part of the surface of a cylinder; margins acute, ciliated, and minutely serrulated; upper

margin produced into a thin expansion overhanging the smooth inner surface; lower margin produced in a similar manner but not nearly so strongly; posterior margin below the articulation of the merus produced backwards into a broadly and evenly rounded lobe; hand narrower and a little shorter than the carpus, broadest at the base, with the ciliated margins more or less incurved towards the proximal end; a prominent hiatus between the fingers; a prominent upturned tooth between the bases of the fingers; fingers a little longer than the palm and furnished with tufts of cilia; dactyl longer than the pollex, minutely denticulated on the inner margin, and bent abruptly near the tip, forming a sharp hook. In the smaller cheliped the ischium resembles that of the larger one but is scarcely denticulated below; merus widest near the middle, shorter than the ischium, and devoid of the lobe at the base, but having an obsolescent tooth near the middle of the lower margin; carpus very long and narrow, with both surfaces convex; hand narrow, relatively much longer than the hand of the larger cheliped, but shorter than the carpus; palm oblong, the margins parallel, the fingers not gaping; dactyl longer than the pollex and not hooked at the tip. The smaller cheliped in the female is like that of the male but the larger cheliped is relatively smaller and of a different form; the ischium is like that of the smaller cheliped and the merus much the same but stouter and furnished with a more prominent inferior tooth; the carpus is similar in shape to that of the other cheliped but relatively shorter, scarcely one-half longer than broad, and but little longer than the merus; both surfaces convex, the margins not produced as in the male; hand as wide as the carpus, palm longer than broad, with the margins subparallel; fingers a little shorter than the palm; dactyl a little dilated near the base and curved at the tip. Ischium and merus of the ambulatory legs fringed with long hairs below; hand ovate, ciliated, much compressed, fingers longer than the palm. Caudal appendages distally truncated. Telson scarcely shorter than the uropods and furnished with a rounded emargination at the tip.

Length of specimen, male, 61 mm.; length of larger cheliped, 50 mm.; of small cheliped, 32 mm.; width of carpus of large cheliped, 13 mm.; length of same, 155 mm.; length of hand to tip of dactyl, 10 mm.; of merus, 12 mm.; of ischium, 10.5 mm.. Length of larger cheliped of a female, 31 mm.; of smaller cheliped, 28 mm.

California (Dana); Mutiny Bay, Alaska (Lockington); Puget Sound (Stimpson); Shoalwater Bay (Cooper); Bodega Bay! San Francisco Bay! Tomales Bay! Santa Barbara! San Pedro!

Callianassa longimana *St.*

Callianassa longimana STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 86; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 490, Pl. XXI, fig. 5. COOPER, Rep. Expl. and Sur. to Pacific Ocean, Vol. XII, Book 2, 1860, p. 388. BATE, in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 279; Challenger Reports, Vol. XXIV, 1888, p. 19. A. MILNE-EDWARDS, Nouv. Archiv. Hist. Nat. Paris, Tome VI, 1870, p. 83. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 302.

Rostrum small but subacute, with two small, lateral teeth as in *californiensis*. Ocular peduncles and antennules much as in the preceding species. Antennæ about one-half as long as the body. The chelipeds in the adult male are narrower than in *californiensis;* the ischium is of similar shape, with the lower margin finely denticulated and the outer surface more or less scabrous; merus similar to that of *californiensis*, but the upper margin is not convex and the lobe at the base is more prominent; carpus oblong, with the margins subparallel, ciliated, thin, but not produced nearly so much as in *californiensis;* outer surface smooth, glossy, and very convex; hand oblong, longer than the carpus, with thin, ciliated, parallel margins and a smooth, convex, glossy, outer surface; fingers shorter than the palm and furnished with tufts of cilia and not widely gaping when closed; the dactyl is dilated near the base, hooked at the tip, and projects but little beyond the pollex; upper edge and inner surface more or less granulated. The smaller cheliped resembles that of *californiensis;* merus widest near the middle, shorter than the ischium, often having a small tooth near the middle of the lower margin; carpus narrow, much longer than the ischium, convex and glossy on both sides, the margins parallel; hand of the same width as the carpus but scarcely as long; palm longer than broad; fingers long, ciliated and contiguous. The larger cheliped in the female is scarcely distinguishable from that of the female of *californiensis*. The smaller chelipeds are also very similar in the two species, but in *longimana* the hand and carpus are somewhat narrower. Ambulatory legs as in *californiensis*. Telson with an obtuse emargination at the tip. Uropods distally truncated and slightly exceeding the telson.

Color whitish.

Length of a male specimen, 39 mm.; length of large cheliped, 39 mm.; ischium, 8 mm.; merus, 8.5 mm.; carpus, 10.5 mm.; hand, 13.5 mm.; length of small cheliped, 22.5 mm.; carpus, 6.5 mm.; width of same, 2.1 mm.; length of merus, 4.2 mm.; hand, 6.2 mm.

Vancouver's Island (Bate); Shoalwater Bay (Cooper); Puget Sound (Stimpson); San Francisco Bay! San Pedro!

San Diego! Santa Barbara Island! Santa Catalina Is.! San Quentin Bay, Lower California (Lockington).

It is remarkable that a species which resembles *californiensis* in almost all other respects should differ from it so markedly in the chelipeds of the adult male. The females are very much alike, but they can be distinguished by the differences in the rostrum and the relative stoutness of the smaller chelipeds.

Callianassa gigas *Dana.*

Callianassa gigas DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 19; Crust. U. S. Expl. Expd., Part I, 1852, p. 512, Pl. XXXII, fig. 3. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 489, Pl. XXI, fig. 3. A. MILNE-EDWARDS, Nouv. Arch. Hist. Nat. Paris, Tome VI, 1870, p. 81. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 302.

Front more or less triangular. Large hand strongly compressed and smooth; fingers similar, shorter than one-half the length of the hand and not gaping, the dactyl arcuate, acute; carpus more than one-half the length of the hand; merus narrow, toothed below at the base. Telson but little shorter than the uropods.

Length 4½ inches.

Puget Sound (Dana).

Callianassa affinis, sp. nov.

Male: Front obscurely tridentate. Ocular peduncles oblong, subacute, the inner margins not diverging toward the tip; cornea in front of the middle of the peduncle. Antennulary flagella subequal. Antennæ about one-half the length of the body. Ischium of the larger cheliped dentate below; merus stout, with a prominent lobe on the under side near the base, the lower side of which is denticulated; carpus short, with the postero-inferior angle broadly rounded and the margin not produced as it is in *californiensis;* hand fully twice the length of the carpus; palm oblong, both inner and outer faces convex; dactyl longer than the pollex, the extremity hooked and the inner margin furnished with a few stout teeth. Smaller cheliped slender; merus widest at the middle; carpus narrow, as long as the hand; fingers pubescent. First pair of ambulatory legs ciliated below. Telson broadly rounded and shorter than the uropods.

Point Loma, Calif.! San Clemente Is.! July, 1895. Collection University of California.

Subtribe HOMARIDEA.

Carapace not strongly compressed and furnished with a more or less flattened rostrum. Antennal acicle present. First three pairs of pereopods chelate, the first pair large; last five pairs of pereopods with seven joints. Abdomen rather wide, the segments overlapping and laterally produced. Tail-fin well developed.

Family ASTACIDÆ.

Carapace subcylindrical; rostrum well developed. Fifth thoracic segment movable. First abdominal segment in the male (and generally also in the female) furnished with sexual appendages. Telson and the outer branch of the uropods divided by a cross furrow.

Terrestrial or fresh water species confined to the northern hemisphere.

Genus **Astacus** *Fabr.*

This genus is distinguished from *Cambarus* chiefly by the possession of a pleurobranchia on the last thoracic segment. The Astacidæ west of the Rocky Mountains belong, without exception, to the genus *Astacus*, while the numerous species inhabiting the Mississippi valley and the eastern states belong to the closely allied genus *Cambarus*.

Astacus klamathensis *St.*

***Astacus klamathensis* STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 87; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 494. BATE in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 278. HAGEN, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 93, Pl. III, fig. 169. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 303. FAXON, Proc. Amer. Acad. Arts and Sci., Vol. XX, 1884, p. 151; Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 131, Pl. VI, figs. 1 and 2; Proc. U. S. Nat. Mus., Vol. VIII, 1885, p. 356; *Ibid.*, Vol. XII, 1890, p. 634; *Ibid.*, Vol. XX, 1898, p. 665.**

A rather small species with a smooth, punctated carapace. Rostrum not so long as in *Trowbridgii*, with the sides converging anteriorly and the dorsal surface concave and marked with an obscure median ridge; terminal tooth acuminate and shorter than in *Trowbridgii;* lateral teeth acute or subacute and not produced into spines; a single spine on either side of

the base of the rostrum, the posterior pair seen in *Trowbridgii* being absent. Dorsal area about twice as long as its width across the middle. Chelipeds much like those of *Trowbridgii* but there is no spine at the antero-internal angle of the carpus. Antero-lateral angles of the abdominal segments rounded; postero-lateral angles subacute.

Length, 95 mm.

Klamath Lake! Sikon Creek; Des Chutes River; Walla Walla, Wenos Valley, Spokane Falls, Washington (Faxon); British Columbia in streams east of the Cascades (Bate); Eel River, Humboldt County, Calif.!

Astacus Gambelii *(Girard).*

Cambarus Gambelii GIRARD, Proc. Acad. Nat. Sci. Phila., 1852, p. 90; *Ibid.*, 1853, p. 380.

Astacus Gambelii AGASSIZ, Proc. Acad. Nat. Sci. Phila., 1853, p. 375. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 492. HAGEN, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 90, Pls. I, III, and XI. LOCKINGTON, Ann. Nat. Hist. (5), Vol. II, 1878, p. 303. FAXON, Proc. Amer. Acad. Arts and Sci., Vol. XX, 1884, p. 152; Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 136; Proc. U. S. Nat. Mus., Vol. VIII, 1886, p. 356; *Ibid.*, Vol. XX, 1898, p. 666.

Carapace obese, punctate. Rostrum short, acute, concave above, with the sides serrated and converging to the tip; a small spine on either side of the base behind which there may be a trace of a second pair. Dorsal area over twice as long as the width across the middle. Chelipeds large; merus much compressed, with the lower margins spinulous, the spine at the antero-internal angle small or absent; a spine on the upper side near the distal end; carpus devoid of spines, the upper edge with a longitudinal median depression; hands large, broad, scabrous, the upper surface of the palm thickly pilose on either side of the middle; lower side of the palm inflated.

Ogden River, Utah; Idaho; Mouth of Yellowstone River, Montana; Wyoming.

This species has been reported from California, but its occurrence there is not entirely certain.

Astacus Trowbridgii *St.*

Astacus Trowbridgii STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 87; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 493. COOPER, Rept. Expl. and Sur. Pacific Ocean, Vol. XII, Book 2, 1860, p. 388. HAGEN, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 93, Pl. III, fig. 171, and Pl. X. FAXON, Proc. Amer. Acad. Arts and Sci., Vol. XX, 1884, p. 152; Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 134; Proc. U. S. Nat. Mus., Vol. VIII, 1885, p. 356. *Ibid.*, Vol. XX, 1898, p. 666.

Carapace obese, punctate, nearly smooth, but roughened by minute prominences at the sides, and furnished with two pairs of spines at the base of the rostrum. Rostrum long, concave above, the sides very slightly converging anteriorly, each ending in an acute, upturned spine separated by a rounded notch from the long, slender, acuminate median spine which is also somewhat upturned. Antennules with a small spine on the lower side of the basal joint near the tip; peduncle shorter than the rostrum. Antennæ shorter than the body, with a strong spine on the outer side of the outer basal joint; acicle acuminate, nearly equaling the rostrum. Epistome triangular. Chelipeds long, but shorter than the body; merus compressed and armed below with a double series of spines, the outer series containing the less number; a strong spine at the infero-distal angle; a spine at the anterior end of the outer surface and another on the upper surface a little behind the anterior end; a spine at the antero-internal angle of the carpus and another on the anterior margin of the lower side; hands large, rough and punctate, with minute setæ in the punctures; fingers narrow, longer than the palm, irregularly dentated within, and spinulous toward the distal end of the outer margins; inner margin of the dactyl convex, the outer slightly concave. The lateral wings of the abdominal segments have the antero-distal angles rounded and the postero-distal angles subacute. Telson longer than broad, the terminal division nearly semicircular. Cardiac area wide.

Length of body, 141 mm.; of cheliped, 106 mm.; of hand, 54 mm.

Columbia River, Oregon! Streams emptying into Shoalwater Bay (Cooper); Monterey (Faxon). The specimen from the latter locality was a large female "said to have been taken from a bunch of seaweed in salt water."

Astacus leniusculus *Dana.*

Astacus leniusculus Dana, Proc. Acad. Nat. Sci. Phila., 1852, p. 20; Crust. U. S. Expl. Expd., Part I, 1852, p. 524, Pl. XXXIII, fig. 1. Stimpson, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 493. Hagen, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 94. Lockington, Ann. Nat. Hist. (5), Vol. II, 1878, p. 304. Faxon, Proc. Amer. Acad. Arts and Sci., Vol. XX, 1884, p. 151; Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 132, Pl. VI, fig. 4; Proc. U. S. Nat. Mus., Vol. VIII, 1886, p. 356. *Ibid.*, Vol. XX, 1898, p. 666.

Closely allied to *Trowbridgii*. Carapace punctate. Rostrum trispinose, the median spine long and slender; two pairs of spines at the base. Cardiac area rather wide. Carpus of the chelipeds unarmed with the exception of the antero-internal angle; merus denticulated and armed with a dorsal spine.

Length, 4 inches.

Columbia River (Dana); San Francisco County, Calif. (Faxon).

Astacus nigrescens *St.*

Astacus nigrescens Stimpson, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 87; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 492. Hagen, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 92, Pl. III. Lockington, Ann. Nat. Hist. (5), Vol. II, 1878, p. 303. Huxley, The Crayfish, p. 244, fig. 62. Faxon, Proc. Amer. Acad. Arts and Sci., Vol. XX, 1884, p. 152; Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 135; Proc. U. S. Nat. Mus., Vol. VIII, 1886, p. 356; *Ibid.*, Vol. XII, 1890, p. 634.

"Margins of the rostrum nearly parallel, denticulated with five or six small sharp spines on either side; the two anterior thoracic spines rather long. Dorsal area between the branchial regions as wide as in *A. Gambellii*, from which this species differs in its smaller and more slender hands, which are also without pubescence. The lateral angles of the abdominal segments are sharp, and the caudal segment has two slender spines on each side.

Color, blackish.

Length three inches."

Unalaska, Alaska; Fort Steilacoom, Washington; San Joaquin Slough, Coyote Creek, Santa Clara County; Alameda Creek, Alameda County, California (Faxon).

Astacus oreganus *Randall.*

Astacus oreganus RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 138, Pl. VII. DEKAY, Zoology of New York, Part 6, Crustacea, 1844, p. 23. ERICHSON, Wiegmann's Archiv. f. Naturg, (1), Bd. XII, 1846, p. 375. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 495. HAGEN, Ill. Cat. Mus. Comp. Zool. Harvard Coll., No. 3, 1870, p. 95. FAXON, Mem. Mus. Comp. Zool. Harvard Coll., Vol. X, No. 4, 1885, p. 133.

Randall's description of this species is as follows:—

"Body fuscous, granulated, carpus with a sharp spine at the anterior angle; arm produced into a spine on each side anteriorly; thorax behind the front with five spines placed three before and one on each side behind the lateral ones; a large reddish spot on each side posteriorly; front little reflected on the sides, terminating in a long, slender spine and having a short, marginal spine on each side. Lon. 4". Testa granulata, bimaculata, fronte valde producta."

Columbia River.

Randall's specimen of this species has, unfortunately, been lost and nothing answering to his description has since been found. If the species belongs to the genus *Astacus* it differs from all the *Astaci* that are now known in the possession of a median thoracic spine. The figure accompanying Randall's description is so obviously inaccurate that it has no scientific value whatever. Dr. Hagen suggests that *oreganus* may be the same as *leniusculus*, as both species come from the same locality. Faxon considers the species indeterminate.

The species described by Randall as *Nephrops occidentalis* was doubtless wrongly reported, through an exchange of labels, from Western America, instead of the Sandwich Islands. Ortmann, who puts the species in the genus *Enoplometopus* unites with it *E. pictus* A. Milne-Edwards.[1]

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[1] See Kingsley, Bull. Essex Inst., Vol. XIV, 1883, p. 131, Pl. II, fig. 1, and Ortmann, Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 274.

Subtribe LORICATA.

Body not strongly compressed and often depressed. Rostrum broad, short or absent. Outer antennæ devoid of an acicle, the first joint of the peduncle fused with the epistome. All of the pereopods six-jointed, and none of them chelate except the last pair which is sometimes subchelate in the female. First abdominal segment devoid of appendages in both sexes. Posterior portion of the telson and uropods flexible. Gills trichobranchiate.

Genus **Panulirus** *White.*

Carapace spiny. Ocular peduncles small, free. Upper portion of the antennular segment wide, nearly horizontal, fused with the carapace, the surface furnished with spines, the sides smooth where they are rubbed by the bases of the widely separated antennæ. Flagella of the antennules long. Rostrum absent. A pair of spines on the anterior margin of the carapace over the eyes. Epistome devoid of a longitudinal furrow. Fifth pereopods of the female subchelate.

Pfeffer discards the name *Panulirus* on account of its similarity to *Palinurus*, the former name being derived from the latter by simply transposing the position of some of the letters. This does not appear to me a sufficient reason for discarding a generic name.

Panulirus interruptus *(Randall).*

Palinurus interruptus RANDALL, Journ. Acad. Nat. Sci. Phila., Vol. VIII, 1839, p. 137. GIBBES, Proc. Amer. Ass. Adv. Sci., 1850, p. 194.

Panulirus interruptus STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 88; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 491. RATHBUN, R., The Fisheries of the U. S., Sec. 1, 1884, p. 780, Pl. 320. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. X, 1897, p. 260.

Senex interruptus ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. VI, 1892, p. 23.

Carapace subcylindrical and covered with short spines. Rostral horns subparallel, compressed, and curved forwards. Upper portion of the antennulary segment with two pairs of spines, the margins raised and polished. The peduncle of the antennules slightly exceeds that of the antennæ; first joint about as long as the next two; second joint about three-fourths as long as the third; flagella longer than the peduncle, the

outer one setose on one side except near the base. Peduncle of the antennæ armed with short, strong spines; flagellum spinulous, compressed at the base, and exceeding the body in length. Epistome with the truncated anterior end armed with five or more spines, the median and outermost spines the largest. Ambulatory legs smooth, pubescent distally, the coxæ of the last pair armed with a pair of spines. Abdominal segments furnished with a pair of transverse dorsal setose sulci which do not meet in the middle line except on the sixth segment. Telson spinulous at the base.

Southern California to Mexico. This is the common "spiny lobster" of the markets.

P. gracilis Streets, which has been united with *interruptus*, differs from the latter, according to Ortmann who has examined the types of both species, in having no transverse sulci on the segments of the abdomen.

Subtribe CARIDEA.

Body generally laterally compressed, the integument usually of flexible corneous texture. Carapace not united to the epistome. Antennules with a three-jointed peduncle, usually furnished with an external basal spine and two or three flagella. Antennal scale generally well developed. External maxillipeds generally pediform. Either, both, or neither of the first two pairs of pereopods may be chelate, the three posterior pairs always simple. Abdomen long, the sides produced downwards. Caudal fin well developed. Gills phyllobranchiate.

The Caridea are divided by Bate into four groups:—

1. **Crangoninea, with the characters of the single family Crangonidæ.**
2. **Polycarpinea: Carpus of the second pereopods annulated, or divided into secondary joints. Four families, Nikidæ, Alpheidæ, Hippolytidæ, Pandalidæ.**
3. **Monocarpinea: Carpus of second pereopods undivided. This group is divided by Bate into eleven families, only two of which are represented in our limits, the Atyidæ and the Palæmonidæ.**
4. **Haplopodinea: All of the thoracic legs similar. Single family, Hectarthropidæ.**

Family CRANGONIDÆ.

Mandibles slender, incurved, not divided at the apex, and devoid of a palp. External maxillipeds pediform. First pair of pereopods stouter than the second and subchelate, the dactyl closing against the margin of the hand, the pollex spiniform; second pair slender, simple or chelate, the carpus entire; all of the succeeding pairs simple.

Genus **Crangon** *Fabr.*

Rostrum very short and dorsally flattened. Eyes free. Antennules biflagellate. First pair of pereopods stouter than the second and but little longer. Third pair of pereopods slender, subequal to the first pair in length, and terminating in a styliform dactyl; the last two pairs are stouter than the third, and have long, more or less flattened dactyls. Branchiæ five.

Type.—*C. crangon* (Linn.).

Crangon nigricauda *St.*

Crangon vulgaris Owen (non Fabr.), Zool. Beechy's Voyage, 1839, p. 87. Dana, Crust. U. S. Expl. Expd., Part I, 1852, p. 536. Bate, in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 278. Smith, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 212. Kingsley, Bull. Essex Inst., Vol. XIV, 1883, p. 129. Rathbun R., The Fisheries of the U. S., Sec. I, 1884, p. 817. Murdoch, Rep. Int. Polar Expd. to Pt. Barrow, Pt. IV, 1885, p. 138. Bate, Challenger Reports, Vol. XXIV, 1888, p. 485.

Crangon nigricauda Stimpson, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 89; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 496, Pl. XXII, fig. 6. Streets and Kingsley, Bull. Essex Inst. Vol. IX, 1877, p. 108. Kingsley, *Ibid.*, Vol. X, 1878, p. 54. Lockington, *Ibid.*, Vol. X, 1878, p. 159.

Crangon (Steiracrangon) nigricauda Kinahan, Trans. Roy. Irish Acad., Vol. XXIV, 1862, p. 57; Proc. Roy. Irish Acad., Vol. VIII, 1864, p. 68.

Crangon alaskensis Lockington, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 34. Kingsley, Bull. Essex Inst., Vol. X, 1878, p. 54.

Crangon crangon affinis Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, p. 180.

Crangon vulgaris Linn., var. *affinis* De Haan, Walker, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 275.

Carapace with a spine on the gastric area and one on each hepatic region, the three situated in a transverse line. Rostrum short, grooved above, and rounded at the tip. Suborbital and antennal spines present, the latter the larger. Thoracic sternum furnished with a spine between the bases of the third pair of pereopods. The process on the outer side of the base of the antennules is broad, irregularly ovate, and about reaches the tip of the first joint; flagella longer than the peduncle, the inner one (and generally the outer) exceeding the tip of the antennal scale. Antennæ as long as, or longer than the body; acicle about two-thirds the length of the carapace, with the antero-internal angle produced and rounded, extending as far forwards as (often further than) the spine at the outer angle. The external maxillipeds reach about as far forwards as the tip of the antennal scale. The first pair of chelipeds generally extend about as far forwards as the tips of the maxillipeds; merus with a spine near the middle of the lower side; hand oblong, about twice as long as wide, with the edges subparallel; the margin against which the finger closes is regularly convex and more nearly transverse than longitudinal; spinous pollex directed obliquely forwards. Third pair of pereopods slender and a little longer than the second. Antepenultimate abdominal segment carinated above; the sixth segment shows a tendency to become carinated and often has a slight median groove. Telson grooved above, subacute at the tip, and exceeding the sixth plus one-half of the fifth abdominal segment. Uropods narrow, rounded at the tip, and equalling (commonly slightly exceeding) the telson. An acute tooth on the sixth segment on either side of the base of the telson and a spine at the posterior inferior angles, between which there is a median ventral spine which is curved backwards; the posterior three-fourths or more of the ventral surface of this segment is marked by a groove.

Color in life dark gray with a blackish tail.

Alaska to Lower California.

This species differs from *C. crangon* of the Atlantic in having the fifth and sixth abdominal segments carinated above and in the groove on the under side of the sixth segment. It is also distinct from *C. affinis*. *Affinis* has a longer rostrum, a much narrower antennal scale, a much narrower and more acute telson. In the specimen of *affinis* figured by Bate[1] the distal end of the hand is concave and is furnished with a tooth next to the pollex. The corresponding portion of the hand in *nigricauda* is evenly convex.

I have examined the types of Lockington's *Crangon alaskensis*.

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[1] Challenger Reports, Vol. XXIV, Pl. LXXXVI, fig. 1.

Crangon franciscorum *St.*

Crangon franciscorum STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 89; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 495, Pl. XXII, fig. 5. KINAHAN, Trans. Roy. Irish Acad., Vol. XXIV, 1862, p. 47; Proc. Roy. Irish Acad., Vol. VIII, 1864, p. 68. COOPER, Rep. Expl. and Sur. Pac. Ocean, Vol. XII, Book 2, 1860, p. 388. KINGSLEY, Bull. Essex Inst., Vol. IX, 1877, p. 54; *Ibid.*, Vol. XIV, 1883, p. 129, Pl. I, fig. 7. RATHBUN R., The Fisheries of the U. S., Sec. I, 1886, p. 818. SHARP, Proc. Acad. Nat. Sci. Phila., 1893, p. 125. ORTMANN, *Ibid.*, 1895, p. 181.

Near *nigricauda* but more slender; the number and position of the thoracic spines are the same as in that species and the rostrum has almost the same form. Flagella of the antennules markedly unequal, the inner much exceeding, the outer not reaching the tip of the acicle. The antennæ nearly equal, or slightly exceed the length of the body; acicle narrow, about three-fourths the length of the carapace, with the antero-internal angle rounded and not produced beyond the spine at the outer angle. Maxillipeds scarcely reaching so far forwards as the tip of the acicle. Chelipeds more slender than in *nigricauda;* merus with a spine near the middle of the lower side; hand narrowly oblong, more than three times as long as broad, slightly wider and more inflated near the base; the margin against which the finger closes long, convex, and nearly longitudinal; the spinous pollex projects nearly transversely. The remaining pairs of legs similar to those of *nigricauda.* A well developed sternal spine. Antepenultimate abdominal segment rounded above, not at all carinated, with a pair of small spines at the posterior margin at the superolateral angles; sixth segment rounded, and devoid of a carina or groove above, sulcate below, with the spines at the posterior end the same in number and position as in the preceding species. Telson rounded, not grooved above, and tapering to an acute tip. Uropods as in *nigricauda,* generally slightly exceeding the telson.

Color "dark and light yellowish gray mottled. Eyes salmon-colored in life."

Length, 54 mm.; length of cheliped, 18 mm.; of hand, 8 mm.; of antennal scale, 11 mm.; of carapace, 14.5 mm.; width of hand, 2 mm.

Puget Sound; Shoalwater Bay (Cooper); Tomales Bay and Monterey (Stimpson); San Francisco Bay (Stimpson)!

This shrimp is very common in San Francisco Bay, where it is caught in large quantities for the markets.

Crangon nigromaculata *Lock.*

Crangon nigromaculata LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 34.

Crangon nigricauda STREETS and KINGSLEY, Bull. Essex Inst., Vol. IX, 1877, p. 108. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 54. LOCKINGTON, *Ibid.*, Vol. X, 1878, p. 159.

Crangon vulgaris SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 212. KINGSLEY, Bull. Essex Inst., Vol. XIV, 1882, p. 129.

Crangon crangon affinis ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 180.

Closely allied to *nigricauda*, but possessing the following distinguishing marks. It attains a considerably larger size, the rostrum is generally more nearly acute; the antennal scale is narrower and longer, being three-fourths the length of the carapace and subequal to the telson; the hand is a little longer, with the anterior margin more nearly transverse; the antepenultimate abdominal segment is rounded (not carinated) above; the telson is acute at the tip, rounded above, and equaling (often slightly exceeding) the uropods, which are narrower than in *nigricauda*. The most characteristic and striking mark on this species is a large, colored spot on each side of the sixth abdominal segment. This spot has a bluish center surrounded by a black ring, outside of which is another ring of a yellowish color. The sides of the preceding abdominal segments are marked with small, yellow spots. The chelipeds generally reach but little beyond the middle of the antennal acicle. In none of the specimens examined did they reach to the tip. With the exception of these differences this species agrees with *nigricauda* in all the characters mentioned in describing that form.

Although this species was regarded as a "color variety" of *nigricauda* by Kingsley and subsequently ranked as a synonym of that species by its own author,[1] I am convinced that it should be restored to its rank as a distinct species. I have collected large numbers of *nigricauda* and *nigromaculata* from various localities on the coast of California, and have compared numerous specimens of both sexes and of all ages with considerable care. The large color mark on the sixth abdominal segment appears to be an absolutely constant character;

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[1] Bull. Essex Inst., Vol. X, p. 159.

there is nothing corresponding to it or approaching it in any specimen of *nigricauda* I have seen. Both species are often brought up in the same dredge load and they can easily be separated at sight. The two species occur side by side from northern to Lower California without any notable approach to intergradation.

Crangon alba, sp. nov.

Closely allied to *nigricauda*, from which it differs in the following points: The antennal acicle is more narrowed at the tip and the membranous portion does not project forward. Hand slightly wider in the middle. The fifth and sixth segments of the abdomen are evenly rounded above and not at all crested. The lower side of the sixth abdominal segment is not grooved. The telson is evenly rounded above and devoid of a sulcus.

Color nearly white.

Dredged at Monterey, November, 1895. Collection University of California.

Crangon stylirostris, sp. nov.

Resembling *nigricauda*, with the spines on the thorax the same in number and position, with the exception that there is no trace of a spine on the gastric area. Body stouter than in *franciscorum*. The rostrum is longer than in *nigricauda*, narrow, grooved above and tapering to a slender, acute tip, which is curved strongly downwards and much compressed laterally. The antennular peduncle does not reach so far forward as the middle of the antennal scale, the process on the outer side of the basal joint similar to that of *nigricauda;* the second joint of the peduncle is broader than long and much shorter on the outer than on the inner side; inner flagellum longer (but not one-half longer) than the outer, which about equals or a little exceeds the tip of the acicle. Antennæ shorter than the body; acicle about two-thirds the length of the carapace and narrow at the distal end, with the antero-internal angle not at all produced. The external maxillipeds reach nearly to the tip of the antennal scale. The anterior chelipeds closely resemble those of *nigricauda;* a spine near the middle of the under side of the merus; hand oblong, about twice as long as wide, slightly widened distally, with the distal margin convex and oblique; spinous pollex oblique; finger fitting closely against the margin when closed. Second pair of pereopods more slender and a little longer than the third; last two pairs subequal. Sternal spine well developed. Fifth abdominal segment evenly rounded above, having no trace of a carina; sixth segment rounded above, neither grooved or carinated, with the spines at the posterior end the same in number and position as in *nigricauda*, and with no groove on the lower side. Telson short, about equaling the length of the preceding segment and scarcely more than one-half the length of the carapace, the upper surface rounded (not grooved), the tip somewhat obtuse. The uropods are similar to those of *nigricauda* and extend considerably beyond the tip of the telson. Each of the abdominal segments in the male bears a median spine on the ventral side.

Length, 55 mm.; length of carapace, 15 mm.; of antennal acicle, 10 mm.; of telson, 8 mm.; of sixth abdominal segment, 7.5 mm.

Two specimens, male and female, dredged at Trinidad, Humboldt County, Calif., together with numerous specimens of *nigricauda*.

Easily distinguished from the other species on the coast by the absence of a median thoracic spine, the short telson, and the acute rostrum. Collection University of California.

Crangon munitus *(Dana).*

Crangon munitus DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 20; Crust. U. S. Expl. Expd., Part 1, 1852, p. 536, Pl. XXXIII, fig. 5. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 497. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 54; WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 275.

Crangon (Sclerocrangon) munitus ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 179.

Abdomen not sculptured. Carapace seven-carinate, the median carina armed with two small spines. Lateral keels of the carapace smooth and, excepting the second from the median carina, ending in front in spines. Epimera of the abdominal segments without spinules.

Puget Sound (Dana).

I have examined the specimens from Magdalena Bay, Lower California, which Lockington[1] has identified with *munitus*, and cannot agree with him in referring them to that species.

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[1] Bull. Essex Inst., Vol. X, p. 159.

Crangon munitellus *Walker.*

Crangon munitellus WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 275, Pl. XVI, fig. 1.

Body stout. Rostrum concave above and rounded at the tip. Carapace with a median carina with two teeth, and two short, parallel carinæ on either side terminating anteriorly in a tooth. Antennal acicle short and broad, with a strong central rib. Abdomen abruptly contracted at the fourth segment; "sixth segment darker colored than the others; a dark, transverse band on the caudal appendages.

"Length 25 mm."

"Near *C. munitus* Dana, but differs in its much smaller size and in the second carina from the median terminating in a tooth half-way to the orbital margin, while in *C. munitus* it reaches the margin and has no tooth."

Puget Sound.

Genus **Paracrangon** *Dana.*

Rostrum elongate; eyes free. Second pair of pereopods wholly absent; fourth and fifth pairs acuminate, gressorial.

Type.—P. echinatus DANA.

Paracrangon echinatus *Dana.*

Paracrangon echinatus DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 20,; Crust. U. S. Expl. Expd., Part 1, 1852, p. 538, Pl. XXXIII, fig. 6. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 497. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 55. WHITEAVES, Can. Nat. (2), Vol. VIII, 1878, p. 471. SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 212. FAXON, Mem. Mus. Comp. Zool. Harvard Coll., Vol. XVIII, 1895, p. 131. ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 189.

"Beak elongate, obliquely porrect, bidentate at apex, unidentate above near middle, at base below in front a long curved spine. Carapax multispinous, along middle of back unequally four-toothed, either side 5-7 spinous. Abdomen above partly keeled, somewhat sculptured, sides acute. Hand elongate, immovable finger long and very slender. Fourth and fifth pairs of legs nearly naked, subequal.

Length of body, one and three-fourths inches. Length of beak half as long as carapax or rather longer than the line of it along the back. The exterior maxillipeds are very slender and short hairy. The fourth abdominal segment has a tooth and inside of it an emargination either side of middle, and the fifth is nearly similar."

Puget Sound, Oregon, obtained by dredging (Dana). Campbell Is. (Whiteaves); Vancouver's Is. (Smith); California and Japan (Faxon, Miers).

Genus **Sclerocrangon** *Sars.*

Carapace sculptured and armed with spines in the median line. Rostrum securiform, expanded below. First chelipeds stout; second pair slender, elongated, with a narrow hand and short dactyls. Abdomen generally sculptured and carinated above.

Type.—*S. boreas* (PHIPPS).

Sclerocrangon boreas *(Phipps).*

Cancer boreas PHIPPS, Voyage North Pole, 1774, p. 190, Pl XII, fig. 1.

Cancer homaroides FABR. O., Fauna Grœnlandica, 1780, p. 241; Mohr. Isl. Naturh. 1786, p. 108, No. 245, Pl. V.

Crangon boreas FABR., Syst. Ent. Suppl., p. 409. SABINE, Appendix to Parry's 1st Voyage, No. 10, 1821, p. 57. ROSS and OWEN, Crust. in Appendix to Ross' 2nd Voyage, 1835, p. lxxxi.

Cheraphilus boreas KINAHAN, Proc. Roy. Irish Acad., Vol. VIII, 1864, p. 68. MIERS, Ann Nat. Hist. (4), Vol. XX, 1877, p. 57. MURDOCH, Rep. Int. Polar Expd. to Pt. Barrow, 1885, p. 139.

Sclerocrangon boreas SARS, Den Norske Nordhavs-Expedition, VI, Zoologi, Crust., Part 1, p. 15. STEBBING, Crustacea, p. 228. ORTMANN, Zool. Jahrb. Abth. f. Syst., Bd. V, 1890, p. 532.

Crangon (Sclerocrangon) boreas ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 178.

Carapace with three spines on the dorsal carina; a toothed carina on the branchial regions. Rostrum triangular, acute. Abdomen sculptured, the anterior segments with a median dorsal carina, the sixth segment with a double carina with a sulcus between the ridges. Epimera of the abdominal segments with only one spine each. Telson sulcate.

Arctic Europe and America, Labrador, Alaska, Siberia, "California," (Ross and Owen l. c.).

Genus **Nectocrangon** *Brandt.*

Rostrum wanting. Eyes hidden by the carapace. Second pair of pereopods chelate; dactyls of the last two pairs dilated and fitted for swimming. Branchiæ five on each side; none on the second maxilliped.

Type.—*N. lar* (OWEN).

Nectocrangon lar *(Owen).*

Crangon lar OWEN, Zool. Beechy's Voyage, 1839, p. 88, Pl. XXVIII, fig. 1.

Argis lar KRÖYER, Nat. Hist. Tidskr., IV, 1842-3, p. 255, Pl. V, figs. 45-62.

Nectocrangon lar BRANDT, in Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 115. STIMPSON, Proc. Acad. Nat. Sci. Phila., 1860, p. 25; Ann. N. Y. Lyc. Nat. Hist., Vol. X, 1873, p. 125. KINGSLEY, Bull. Essex Inst., Vol. X, 1879, p. 55. SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 212; Trans. Conn. Acad., Vol. V, 1879, p. 61. MURDOCH, Rep. Int. Polar Expd. to Pt. Barrow, 1885, p. 139. ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 181.

Median carina of the carapace armed with two spines behind the one at the anterior end. First five abdominal segments with a median dorsal carina, that of the fifth segment ending behind in a tooth or spine; the two carinæ of the sixth segment end posteriorly in a small spine. Telson acute, the carinæ armed with two or three pairs of spines near the tip.

Circumpolar: Arctic Ocean (Owen, Stimpson); Greenland (Kröyer); Labrador, Nova Scotia, Vancouver's Island (Smith); Pt. Barrow (Murdoch).

Owen's statement, that in this species "the second joint of the superior antenna is dilated and spiniform externally" is an error. He mistook the first joint for the second; the second is cylindrical.

A specimen in the U. S. National Museum (No. 7889) from Alaska agrees very closely with several specimens I have seen from the Atlantic. The ridges on the carapace are a little plainer than in the Atlantic forms; the carinæ on the abdomen are a little less acute and have a more decided tendency to fade out behind; the carina of the fifth segment ends behind in a tooth, but those of the sixth segment do not. In specimens from the North

Pacific (Station 3441 Albatross Collection) the carinæ of the first four abdominal segments fade out before reaching the posterior end, but that of the fifth segment ends behind in a tooth, and the two carinæ of the sixth segment terminate posteriorly in small, acute teeth. In specimens from Vancouver's Island, according to Professor Smith, "the dorsal carina on the third, fourth, and fifth segments of the abdomen is broad and rounded, or flattened, and scarcely reaches the posterior edges of the segments, and the two carinæ on the sixth segment are rounded and fade out in the same way before reaching the posterior extremity of the segment." All of the Pacific specimens I have seen of this species came from farther north than Vancouver's Island, and it is an interesting fact that they are intermediate in character, as in locality, between specimens from the Atlantic and the forms described by Professor Smith.

Nectocrangon alaskensis *Kingsley.*

Nectocrangon alaskensis KINGSLEY, Bull. Essex Inst., Vol. XIV, 1882, p. 128, ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, p. 182.

Carapace with four equally spaced, median spines and a small tooth between the first spine at the anterior end and the second. Orbits elongated. Antennular peduncles reaching about to the middle of the acicle. The abdomen has no carina on the first four segments except a slight one on the anterior portion of the first; the fifth segment has a prominent carina, which ends behind in a spine. The two carinæ on the sixth segment end behind in a spine. Telson acute, with three pairs of spines near the tip.

Alaska (Kingsley); Station 3257 Albatross Collection, numerous specimens!

Family NIKIDÆ

Rostrum horizontal. Ocular peduncles free. Mandibles devoid of a cutting edge and palp. First pair of pereopods simple or chelate. Second pair chelate, longer than the first and more slender, the carpus multiarticulate.

Genus **Hippolysmata** *Stimpson.*

Carapace furnished with an elongated, compressed, dentate rostrum which is nearly horizontal. Antennules furnished with two long flagella. Mandibles strongly incurved, devoid of a palp, the apex undivided. Maxillipeds elongated, furnished with an exognath, and an epipodite, the terminal joint slender. First four pairs of pereopods furnished with an epipodite; the first pair is a little stouter than the others and chelate, the hand oblong; second pair filiform, multiarticulate and chelate. Abdomen smooth above.

Type.—H. vittata STIMPSON.

Kingsley in his Revision of the Genera of Crangonidæ, Atyidæ and Palæmonidæ[1] states, in defining this genus, that the first four pairs of feet are provided with an exopodite. This is probably a clerical error, the word exopodite having been substituted for epipodite. Stimpson says in his definition of this genus: "*Pedes 1 mi–4 ti epipodo instructi.*"[2]

Hippolysmata californica *St.*

Hippolysmata californica STIMPSON, Proc. Chicago Acad. Sci., Vol. I, 1866, p. 48; Ann. N. Y. Lyc. Nat. Hist., Vol. X, 1873, p. 123. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 56.

Hippolyte lineata LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 35. SHARP, Proc. Acad. Nat. Sci. Phila., 1893, p. 116.

Rostrum slender, strongly ridged on the sides, bent downwards near the base, about one-half as long as the carapace, scarcely exceeding the antepenultimate basal joint of the antennules; it is armed above with six or seven teeth, the last tooth situated at considerably more than the usual interval from the preceding one and at about the anterior third of the carapace; below the rostrum is armed with three teeth; a strong spine above and a smaller one below the base of the antenna on the anterior margin. The spine on the outer side of the basal joint of the antennules reaches about two-thirds as far as the tip; last joint of the peduncle nearly as long as the preceding one; flagella subequal and longer than the body. Antennal acicle elongated, exceeding the tip of the antennular peduncle, and wide at the tip, where it is transversely truncated or broadly rounded. External

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[1] Proc. Acad. Nat. Sci. Phila., 1879, p. 413.

[2] See Proc. Acad. Nat. Sci. Phila., 1860, p. 26.

maxillipeds equalling or exceeding the tips of the antennal scale, the terminal joint elongated and spinulous at the tip. In the first chelipeds the hand is narrow, a little longer than the carpus; fingers about two-thirds as long as the palm. Second pair of pereopods very long and slender; ischium stouter than the merus and about as long, and more or less annulated towards the tip; merus divided into something over twenty annulations; carpus about as long as the merus and ischium combined and divided into about thirty-two annulations; hand minute, oblong, the fingers scarcely as long as the palm. The three posterior pairs of pereopods are subequal in length, much longer than the first pair, but shorter than the second; merus joints stouter than the distal ones and armed with scattered spinules; propodi elongated, minutely spinulous below; dactyls very short and armed below with spines. Postero-lateral angle of the fifth abdominal segment acute; that of the fourth segment rounded. Telson subacute, much shorter than the uropods, and armed on the rounded dorsal surface with two pairs of spinules.

This beautiful species is very conspicuously marked with longitudinal stripes of drab and red or reddish brown.

Length from tip of rostrum to tip of telson, 47 mm.; length of carapace from tip of rostrum, 17 mm.; length of acicle, 9.5 mm.; of first pair of chelipeds, 15 mm.; of second pair, 25 mm.; of third pair, 22 mm.; of telson, 7 mm.

San Diego (Stimpson)! Santa Catalina Is. (Lockington)! San Pedro! Found in tide pools.

I have examined the type specimens of Lockington's *Hippolyte lineata*. They unquestionably belong to the above species.

Family ALPHEIDÆ.

Rostrum small or absent. Eye-peduncles short and concealed beneath a projection of the frontal margin of the carapace. Mandibles deeply divided at the apex and furnished with a palp. First pair of pereopods chelate and larger than the second pair which is slender, chelate and has the carpus annulated. Telson broad and rounded.

Genus **Alpheus** *Fabr.*

Carapace compressed, rounded above. Rostrum short or absent. Eyes completely hidden beneath the carapace. Antennules biflagellate. Mandibles stout, the apical process narrow, palp two- or three-jointed.

Anterior chelipeds stout, often very unequal. Second pair filiform, carpus cylindrical, annulated, hands small.

Type.—*A. rapax* FABR.

KEY TO THE SPECIES OF *Alpheus*.

Front with a rostrum.
  A spine on the infero-distal angle of the merus of the ambulatory legs .... *A. clamator.*
  No meral spine.
    No spine on the second basal antennal joint.......... *A. barbara.*
    A spine on the basal antennal joint.
      Front trispinose.
        Fingers of larger hand longitudinal; dactyl working nearly vertically............*A. equidactylus.*
        Fingers of large hand not longitudinal; dactyl short, curved, working horizontally...*A. bellimanus.*
      Front with but one spine.....................*A. californiensis.*
Front devoid of a rostrum; dactyl joined to the lower side of the hand (Genus *Betæus* Dana).
  Front emarginate in the center; hands oval.................*A. æqualis.*
  Front not emarginate in the center; hands long and narrow..*A. longidactylus.*

Alpheus clamator *Lock.*

Alpheus clamator LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 43; Ann. Nat. Hist. (5), Vol. I, 1878, p. 469. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 58; *Ibid.*, Vol. XIV, 1883, p. 117.

Alpheus transverso-dactylus KINGSLEY, Bull. U.S. Geol. Sur., Vol. IV. No. 1, 1878, p. 196; Bull. Essex Inst., Vol. X, 1878, p. 58.

Alpheus candei KINGSLEY (not GUERIN), Bull. Essex Inst., Vol. XIV, 1883, p. 124.

Front trispinose, the median spine short and separated by a deep sulcus from the small, acute, lateral spines which project nearly as far forward. Antero-lateral angle of the carapace devoid of a spine. Basal spine of the antennules broad, scarcely reaching the extremity of the first joint; second joint about twice as long as the third; outer branch of the flagellum much shorter than the inner one, the slender terminal portion shorter than the basal part; inner flagellum longer than the carapace. Second joint of the antenna with a spine below the articulation of the acicle; acicle narrow, nearly as long as the peduncle, with the outer side concave and ending in a strong spine which is separated by a deep, narrow cleft from the membranous inner portion; flagellum longer or shorter than the body. Maxillipeds about equaling the antennal peduncle. Chelipeds very unequal;

merus of both trigonous, compressed, smooth, the upper surface edge ending abruptly, forming a sharp angle or tooth; carpus of smaller cheliped rounded, with a tooth at the anterior end of the upper side; carpus of the large cheliped very short, especially below, and devoid of teeth; large hand oblong, compressed, and greatly developed, being considerably larger than the thorax; proximal portion smooth and nearly naked, the distal portion deeply sculptured; a little in front of the middle of the palm the upper and lower edges are crossed by deep, transverse sulci, which are nearly opposite each other and are continued towards each other on the inner surface of the hand, their ends being separated by a shallow, longitudinal depression; the upper transverse sulcus is curved abruptly forwards a little external to the upper edge of the hand and joins a deep, transverse sulcus on the outer face behind the articulation of the finger; this last sulcus is continuous at its lower end with a longitudinal sulcus which ends near the middle of the palm; the transverse sulcus crossing the lower edge of the hand is curved abruptly forwards a little external to the lower margin, forming a longitudinal sulcus which extends to the end of the pollex; this sulcus is separated from the longitudinal one above by a ridge which narrows distally and terminates in a curved spine or tooth just below the articulation of the dactyl and behind a short groove uniting the lower longitudinal sulcus with the one above it; dactyl flattened, inclined downwards, but working horizontally, the outer margin strongly convex, the inner concave near the thickened tip, but widened into a concave prominence near the base; the postero-external angle is flattened, forming a smooth surface which, when the finger is opened, abuts against a similarly flattened prominence behind it; pollex deeply grooved for the reception of the dactyl, ending below in a short, curved tooth. The small hand is several times smaller than the larger one and not so deeply sculptured; the fingers are similar, longitudinal, and about as long as the palm, which is oblong and compressed; a small carina on the upper edge of the dactyl which does not reach the tip; a spine behind the articulation of the dactyl. Carpus of the second pair of legs five-jointed, the first two joints subequal, each about as long as the fourth and fifth combined; third and fourth joints subequal, each shorter than the fifth; hand narrow, fingers slightly longer than the palm, which is subequal to the last joint of the carpus. The two following pairs stout, the merus large and armed with a spine near the infero-distal angle; carpus with a spine at the infero-distal angle and another further back; propodi with five or six spines below. Last pair of legs much less stout than the preceding pairs; merus and carpus devoid of a spine at the infero-distal angle; spines on the propodi feeble; dactyls of all the pairs short, curved, with a small spine behind the tip. Telson furnished above with a broad, shallow groove and two pairs of spinules.

Length of body, 31 mm.; of carapace, 11 mm.; of large hand, 18 mm.; of small hand, 11 mm.

Farallon Is.! Monterey! Santa Barbara! San Pedro! San Diego! San Bartholome Bay, Lower California (Lockington).

Kingsley[1] unites his *Alpheus transverso-dactylus* with *A. candei* Guerin from the Bermuda Islands and the West Indies, at the same time listing *A. clamator* Lock. as a distinct species. But as Kingsley's description of *transverso-dactylus* agrees perfectly with *clamator*, and as his specimens came from a locality where that species is abundant, there is no doubt in my mind that Kingsley's species is identical with the latter form. Having described as *clamator*[2] what was really a distinct species, *A. barbara* Lock., Kingsley made out of specimens which really belonged to *clamator* a new species, *transverso-dactylus*. I am unable, moreover, to follow Kingsley when he subsequently unites his *transverso-dactylus* with *A. candei*. *Candei*, according to Guerin,[3] "a la pièce basilaire des antennes externes prolongée en une longue pointe qui atteint la moité de la longeur de l'appendice lamelleaux," while in *clamator* this spine does not reach one-third the length of the acicle. In *candei* "les cuisses des troisieme et quadrieme pattes n'ont pas de dents," while in *clamator* both bear a prominent spine-tooth. The rostrum is smaller in *candei* than in *clamator*, and there are differences in the form of the larger hand.

Alpheus bellimanus *Lock.*

Alpheus bellimanus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 34; Ann. Nat. Hist. (5), Vol. I, 1878, p. 470. KINGSLEY, Bull. U. S. Geol. Sur., Vol. IV, No. 1, 1878, p. 199; Bull. Essex Inst., Vol. X, 1878, p. 59; *Ibid.*, Vol. XIV, 1883, p. 111.

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[1] Bull. Essex Inst., Vol. XIV, p. 124.

[2] Bull. U. S. Geol. Sur., Vol. IV, No. 1, p. 197.

[3] De Sagra's Hist. de Cuba; Crustacés, 1857, p. 50, Pl. II, figs. 9 and 9*a*.

Allied to *clamator*. Front trispinose, the median spine the largest and not separated from the lateral spines by sulci. Antennules as in *clamator;* the acicle of the antennæ about reaches the tip of the peduncle and is similar to that of *clamator* but the cleft between the spine and the inner portion is not so deep as in that species. Maxillipeds pubescent, reaching to the tip of the antennal peduncle. Chelipeds unequal, dissimilar; resembling those of *clamator*, but presenting the following differences: The transverse sulcus on the lower side of the larger hand is prolonged posteriorly on the inner side of the lower edge as a longitudinal sulcus, a feature not present in that species; there is no longitudinal sulcus on the inner surface of the hand separating the inner ends of the transverse sulci, and the upper, transverse sulcus is not so deep as in *clamator*. The smaller hand is sculptured much like the larger one but the sulci are not so deep, nor the ridges so prominent; the pollex is rather slender, a little shorter than the palm, and nearly longitudinal, curving a little downwards and having a ridge on the outer side a little above and parallel with the outer edge, the surface above which is somewhat excavated for the reception of the lower margin of the dactyl; dactyl contracted at the base but expanded a short distance beyond into a high, thin, rounded lamina, the plane of which is nearly vertical; the lower edge is nearly straight when seen from the side but curved when seen from below and ends in a short tooth which is curved downward and inward; its postero-external angle has a flattened projection which, when the finger is opened, abuts against a flattened projection of the palm as in the larger hand. Carpus of the second pair of legs five-jointed, the first joint about as long as the next two combined, second and fifth joints subequal and each about as long as the third and fourth together; hand narrow, fingers a little longer than the palm which is somewhat shorter than the last joint of the carpus. The two following pairs of legs not so stout as in *clamator*, neither the merus nor carpus with a spine at the infero-distal angle; propodi armed below with seven or eight pairs of spines; dactyls short, curved and devoid of a subterminal spine.

Length, 33 mm.; length of carapace, 12 mm.; of large hand, 17 mm.; of small hand, 13 mm.

Monterey; Santa Barbara! San Pedro! San Diego!

Alpheus barbara *Lock.*

Alpheus clamator KINGSLEY (not LOCKINGTON), Bull. U. S. Geol. Sur., Vol. IV, No. 1, 1878, p. 197.

Alpheus barbara LOCKINGTON, Ann. Nat. Hist. (5), Vol. I, 1878, p. 471. KINGSLEY, Bull. Essex Inst., Vol. XIV, 1883, p. 117.

I have seen no specimens of this species. It was described by Kingsley from a single imperfect specimen which he erroneously considered to belong to *clamator* Lock. Afterwards Lockington, perceiving that Kingsley's *clamator* was not true to name, rechristened the species *A. barbara*. The following is Kingsley's description:

> "Basal spine of antennulæ stout, short, not reaching second joint of peduncle; third joint half as long as preceding. Antennæ without spine on the basal joint. Antennal scale narrow, the spine at the antero-exterior angle acute, slender, reaching the end of the antennular peduncle. External maxillipeds rather broad, extending slightly beyond the antennal scale. Feet of first pair unequal. Merus smooth, with a very slender spine on the distal portion above. Larger hand compressed, a constriction of each margin at about the middle, a spine above the articulation of the dactylus, behind which a sulcus runs obliquely across the superior margin. A second spine on the outside; thumb slender; dactylus compressed, semicircular in outline viewed from the side, slightly longer than the thumb. Smaller hand with both margins constricted; upper margin of palm tuberculate; a spine above the articulation of the dactylus; fingers about equal to the palm, completely closing. Ischium and merus of second pair equal; carpus five-jointed, first two joints equal, and each as long as the third and fourth, which are also equal; fifth joint nearly as long as the first. Merus joints of posterior pairs without spines; propodal joints spinulose beneath; dactyli slender. Santa Barbara, Cal. (W. G. W. Harford)."

Alpheus californiensis, sp. nov.

Anterior portion of the carapace convex and furnished with a fine longitudinal line. Rostrum short, acute, continuous behind with a short carina, which is separated from the ocular lobes on either side by a deep groove. Ocular lobes rounded in front and devoid of a tooth or spine. Antero-lateral angle of the carapace broadly rounded. Basal antennular spine broadly ovate, acuminate, and scarcely reaching the tip of the first joint of the peduncle; third joint of the peduncle less than half the length of the second; outer flagellum nearly one-half as long as the inner one, the slender, terminal part about one-half the length of the basal portion; inner flagellum about one-half the length of the body. Antennæ about as long as the body; peduncle slightly exceeding that of the antennules; a small spine on the infero-distal margin of the second basal joint; acicle not reaching the tip of the peduncle, outer margin slightly concave and terminating in a strong spine, which is separated from the membranous portion by a deep, narrow cleft. Maxillipeds somewhat exceeding the antennal peduncle. Anterior chelipeds very unequal; merus of both members compressed, and devoid of a spine at the supero-distal angle; carpus without a tooth or spine; hand of large cheliped large, oblong, compressed, upper and lower sides constricted near the middle, the upper constriction formed by a short, transverse groove a short distance behind the dactyl; pollex curved upwards and inwards at the tip and deeply excavated at the base for the reception of the dactyl; dactyl compressed, shorter than the palm, the outer margin strongly convex, the inner more or less concave and having a flattened process near the base which fits into the excavation in the pollex. Smaller hand long, narrow, pubescent, somewhat compressed and devoid of sculpturing; fingers narrow, straight, subequal to the palm, the tips hooked and crossing when closed. First joint of the carpus of the second pair of legs long, exceeding the second, which is about as long as the next two combined; third and fourth joints subequal, each a little shorter than the fifth; hand shorter than the last two joints of the carpus. The two following pairs of legs are stouter than the last pair; merus devoid of a spine; propodi strongly spinose below. The sides of the first five abdominal segments are rounded. Telson broadly rounded at the tip and armed above with two pairs of spinules.

Length, 37 mm.; length of carapace, 12.5 mm.; of large hand, 15 mm.; of small hand, 9 mm.

San Pedro, Calif.; dredged in the harbor, July, 1895. Collection University of California.

Alpheus equidactylus *Lock.*

Alpheus equidactylus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 35; Ann. Nat. Hist. (5), Vol. 1, 1878, p. 472. KINGSLEY, Bull. U. S. Geol. Sur., Vol. IV, No. 1, 1878, p. 199; Bull. Essex Inst., Vol. X, 1878, p. 59; *Ibid.*, Vol. XIV, 1883, p. 111.

Carapace smooth, convex longitudinally on the upper side. Front trispinose, the median spine considerably larger than the lateral ones and not separated from them by sulci. Basal spine of the antennules long, reaching nearly to the tip of the second joint of the peduncle; last two basal joints short and subequal; outer flagellum shorter than the more slender inner one, the slender part much longer than the basal portion. Second joint of the antenna with a spine below the acicle; acicle rather wide, longer than the peduncle. Maxillipeds sparingly pubescent and about reaching the tip of the antennal scale. Anterior chelipeds smooth, naked, unequal, but of similar form; merus with the angles rounded and devoid of spines or teeth; carpus short, similar to that of the larger cheliped in *clamator;* hands oblong, narrow, compressed, smooth; a transverse sulcus crossing the upper edge of the hand behind the dactyl, from which a narrow, deep, longitudinal sulcus extends backwards on the upper edge in the larger hand almost to the posterior margin, but about two-thirds as far in the smaller one; fingers longitudinal, subequal (the dactyl slightly the longer), and working nearly vertically; pollex rather slender, tapering, the tip curved upwards and the inner margin armed near the base with two or three small teeth; dactyl, with one or two very small teeth near the base of the straight inner margin, the tip curved and crossing that of the pollex when closed; smaller hand more slender than the larger one, the fingers somewhat narrower, otherwise very similar. Carpus of the second pair of legs five-jointed, the first joint about as long as the four following ones combined, second, third and fourth joints subequal, the fifth a little longer; hand narrow, the fingers longer than the palm. Posterior pairs of legs slender; merus and carpus devoid of spines; dactyls with very slender tips. Sixth abdominal segment with a postero-lateral spine. Telson tapering, rounded above where it is furnished with two pairs of spinules, the tip rounded.

Length of body, 18 mm.; of carapace, 6.5 mm.; of larger hand, 7 mm.; of smaller hand, 5 mm.

Monterey (Lockington)! Santa Barbara!

Mr. Kingsley has united *A. equidactylus* Lock. with *A. heterochelis* Say,[1] probably on Lockington's authority, for he says: "Mr. Lockington informs me that his *A. equidactylus*, from Monterey, Cal., presents no appreciable differences from specimens of *A. heterochelis*, from Florida, that I sent him." There is evidently a mistake here, for *heterochelis* and *equidactylus* are so different that it is scarcely credible that they should be regarded as members of the same species by anyone who had carefully compared them. Lockington's species was described from a single, imperfect, dried specimen which had lost one of the anterior chelipeds, which Lockington in his later description of the same specimen was inclined, in opposition to his previous opinion, to regard as the larger member. Both hands in this species are elongated much like the smaller hand in *heterochelis* and, from a superficial comparison, Lockington probably concluded that his specimen was a

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[1] Proc. Acad. Nat. Sci. Phila., 1887, p. 329.

heterochelis with the larger hand lost. The two species may, however, readily be distinguished aside from the great differences in the larger chelipeds, as *heterochelis* has no ocular spines, while in *equidactylus* the front is "trirostrate, without sulcus between rostrum and ocular spines" (Lockington). I have examined Lockington's type which has now lost both its hands.

Alpheus (Betæus) æqualis *(Lock.)*.

Betæus equimanus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 43.
Alpheus Harfordi KINGSLEY, Bull. U. S. Geol. Sur., Vol. IV, No. 1, 1878, p. 198; Bull. Essex Inst., Vol. X, 1878, p. 58; *Ibid.* Vol. XIV, 1883, p. 124, Pl. II, fig. 4.
Alpheus æqualis KINGSLEY, Bull. U. S. Geol. Sur. Vol. IV, No. 1, 1878, p. 199.
Betæus æqualis LOCKINGTON, Ann. Nat. Hist. (5), Vol. I, 1878, p. 478.

Carapace moderately compressed, the dorsal side nearly straight. Front devoid of spines, emarginate in the middle and rounded in front of the eyes. Basal spine of the antennules long and slender, reaching beyond the middle of the second joint; second joint about twice the length of the third; the inner flagellum may exceed the length of the carapace; outer flagellum much shorter than the inner one, with the slender terminal portion subequal to the basal part. Second joint of the antennæ with a spine below the articulation of the acicle; peduncle about equaling that of the antennules; scale narrowly oblong, nearly reaching the tip of the peduncle, the outer margin nearly straight and ending in a strong spine which is separated by a deep, narrow cleft from the membranous portion; flagellum shorter than the body. Maxillipeds scarcely reaching the tip of the antennal peduncle. Anterior chelipeds subequal; merus trigonous, compressed, scarcely more than twice as long as high; carpus devoid of a tooth or spine; hands oval, vertical, smooth, strongly compressed, and devoid of grooves or inequalities; dactyl slender, articulated on the lower side of the hand, and working vertically, the inner margin straight or somewhat concave near the base; pollex much wider than the dactyl; the entire inner margin may be straight, or there may be a deep, rounded notch near the base; tips of the fingers curved and crossed when closed; inner margins pubescent, the rest of the hand naked. Carpus of the second pair of legs five-jointed, the first joint about as long as the three following ones combined, which are subequal and shorter than the fifth; hand narrow, palm nearly as long as the fingers or the last joint of the carpus. Posterior legs slender; dactyls short, with a subterminal spine. Postero-lateral angle of the sixth abdominal segment acute, that of the two preceding segments subacute. Telson tapering, rounded at the tip, and armed on the convex dorsal surface with two pairs of spinules.

Color in life a dark purple.

Length of body, 19 mm.; of carapace, 6 mm.; of hand, 6 mm.

Catalina Island (Lockington)! Santa Barbara (Kingsley); Point Arena!

This species is found under the mantle of the Abalone, *Haliotis rufescens*, but it is not confined to that habitat, for I found several specimens upon some sea-urchins that were brought up from several feet of water at Catalina Island. Their color was a dark purple like the specimens described by Lockington and resembled the color of the sea-urchins in whose spines they were entangled when captured. At Point Arena I captured from under a rock at low tide a single specimen, which was nearly white.

Alpheus (Betæus) longidactylus *(Lock.)*.

Betœus longidactylus LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 35; Ann. Nat. Hist. (5), Vol. I, 1878, p. 480.

Alpheus longidactylus KINGSLEY, Bull. U. S. Geol. Sur., Vol. IV, No. 1, 1878, p. 198; Bull. Essex Inst., Vol. X, 1878, p. 58; *Ibid.*, Vol. XIV, 1883, p. 124.

Carapace quite strongly compressed and smooth, with no trace of a rostrum or ocular spines, and scarcely notched at the center. No spines or teeth on the anterior margin of the carapace. Basal spine of the antennules slender, elongated, about reaching the tip of the second joint; last two basal joints subequal; inner flagellum a little longer than the carapace, the outer one considerably shorter than the inner and contracted near the middle, the terminal portion slender. Antennæ with a spine at the infero-distal angle of the second basal joint; scale with a prominent terminal spine which nearly reaches the tip of the peduncle, the latter reaching about as far forward as the peduncle of the antennules. Maxillipeds nearly reaching the tip of the antennal peduncle. Chelipeds elongated, similar; merus with rounded angles, the distal end widened, the outer surface with a broad, oblique sulcus; a short, transverse groove at the supero-distal angle, behind which the upper margin ends abruptly but does not terminate in a spine; the surface is granulated, the lower side granulo-spinulous; carpus short, rounded; hand large, oblong, compressed, scabrous, the margins rounded, the length much exceeding that of all the preceding joints combined; fingers slender, widely gaping, longer than the palm, the tips furnished with small, curved, corneous claws, which are crossed when the fingers are closed; pollex with a large tooth a little behind the middle of the inner margin and a small, round tooth at the base. Carpus of the second pair of legs five-jointed, the first joint about as long as the three following ones combined; second, third, and fourth joints subequal, the fifth a little longer; hand oblong; fingers about as long as the palm, which is about one-half longer than wide and nearly as long as the last joint of the carpus. Postero-lateral angles of the fourth and fifth abdominal segments acute. Telson tapering, rounded at the tip, with two pairs of spinules above. On the outer side of the distal end of the peduncle of the uropods there is a pair of prominent spines, behind which is a small third spine; a spine near the outer angle of the uropods. "Color of carapax of dried specimen green with nuances of russet and olive. The fingers of larger hand are light red, the tips green."

Length, 1.12 inch; length of larger hand, 0.56; of smaller hand, 0.36.

San Diego (Lockington)! San Pedro!

This description is taken from Lockington's type specimen (No. 96), which is preserved in the California Academy of Sciences. The specimen was dried and had lost most of its ambulatory legs. The unequal size of the chelipeds is exceptional.

Since writing the above description I have collected numerous specimens of this species at San Pedro, Calif., where it is found in abundance in tide pools on a rocky ledge near the entrance to the harbor. The hands are similar and generally equal and very much larger in adult males than in young males and females. The anterior margin of the carapace in some specimens is slightly convex, in others straight, while in a few it is slightly concave. In many adult females, and to a less extent in the adult males also, the dorsal surface of the carapace is bulged upwards, owing, doubtless, to the enlargement of the ovaries or testes. Many of the specimens were infested with a parasitic Isopod attached to the under side of the abdomen. The color varies in living specimens from olive green to olive brown; the legs are reddish, and in many specimens there is a light-colored dorsal stripe along the middle of the body. The specimens were taken June 25, 1895; most of the females were carrying ova.

Family HIPPOLYTIDÆ.

Rostrum generally prominent. Eyes not covered by the carapace. Mandibles with or without a cutting edge and palp. First pair of legs chelate and stouter than the second pair which is also chelate and has the carpus annulated.

The genera of this family need a thorough revision. The genus *Hippolyte* has long been a sort of receptacle for a large and somewhat miscellaneous assemblage of forms. Bate has instituted several new genera for many of the species but several more will doubtless be required. Most of the Pacific species of this family fall naturally into a group which I have characterized as the genus *Heptacarpus*.

Genus **Hippolyte** *Leach*.

Carapace produced into a laterally compressed, serrated rostrum which is excavated at the under side of the base. A supraorbital and antennal spine present. Ocular peduncles short. First joint of the antennular peduncle excavated above and armed with an external basal spine; second and third joints subcylindrical, the terminal one supporting two flagella, the outer of which is the shorter and more robust. Antennal scale with a spine at the distal end of the outer margin. Third maxillipeds with a short exognath and having the last joint armed with spinules at the tip. First pereopods short and stout with the carpus excavated at the extremity to receive the base of the hand. Second pair slender, a little longer than the first, and having the carpus three-jointed. The three following pairs of legs decrease slightly in length posteriorly; dactyls spinulous below. Abdomen smooth, the third segment posteriorly produced in the median dorsal line and somewhat arcuate. Branchiæ five.

Type.—H. variens LEACH.

Bate's diagnosis of this genus was based on an examination of Leach's type specimens of *varians*. I have slightly modified Bate's description, as some of the species which Bate himself refers to *Hippolyte* contradict the characters of the genus as he defines it.

Hippolyte californiensis *Holmes*.

Hippolyte californiensis HOLMES, Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 576, figs. 21-26.

A long slender species. Rostrum slender, slightly upturned, a little longer than the carapace; upper margin armed with 3-5 teeth; lower margin with 4-5 teeth; base of the rostrum rounded and not continued upon the carapace. A supraorbital spine. Peduncle of the antennules about one-half as long as the rostrum; outer flagellum much shorter than the slender inner one, the last few joints much narrowed. First pair of chelipeds very short; hand broad and thick at the base, which fits into a depression in the carpus. Second pair of chelipeds more slender but much longer than the first pair; carpus three-jointed, the first joint the longest. Abdomen not crested or carinated. Telson truncated and spinulous at the tip.

Length, 38 mm.

Bodega Bay, Calif., in the eel-grass! San Pedro! San Diego! Specimens from the last named locality are considerably smaller than those from Bodega Bay.

Hippolyte Layi *Owen*.

Hippolyte Layi OWEN, Zool. Beechy's Voyage, 1839, p. 90, Pl. XXVII, fig. 3. BRANDT, in Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 117. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 499. BATE, in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 279. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 62. LOCKINGTON, *Ibid.*, 1878, p. 161.

I have seen no specimens which I can refer to *H. Layi*. Owen's short description of this species is as follows:

"Hip. rostro acuminato, supra multi-serrato, ante medium subtus quadri-serrato. Long. corp. unc. 2¼. Color ruber."

A little more light on the subject is given in the discussion of the affinities of this species. "In addition to the difference in the serrations of the rostrum, which probably varies in different individuals of the same species (although the number was constant as above quoted in three specimens of each species which was preserved), *Hip. Layi* has a longer and narrower rostrum, extending to the extremity of the superior antennæ; the inferior seta of these antennæ is also proportionately longer. *Hip. affinis* has a spine above the eye, at the root of the rostrum, which is wanting in the *Hip. Layi;* whilst this species has the fifth and sixth abdominal segments unispinous inferiorly on each side, *Hip. affinis* having the sixth segment only so armed.

"From the *Alpheus Polaris* of Sabine (Zool. Appendix to Parry's Voyage, p. 238, Pl. II, fig. 5) which is a *Hippolyte* of Leach, and from the species characterized by the latter author in the Malacostraca Podoph. Brit., the above species differ in the forms and proportions, as well as in the serrations of the rostrum."

Monterey (Owen); Vancouver's Island (Bate); Alaska (Lockington).

It is impossible to determine from Owen's description and figure in what genus this species belongs. It is certainly not a *Hippolyte;* it may be a *Heptacarpus*, but until more is known concerning it, it is best, I think, to leave its name unchanged.

Hippolyte affinis *Owen.*

Hippolyte affinis OWEN, Zool. Beechy's Voyage, 1839, p. 90, Pl. XXVII, fig. 4. BRANDT, in Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 117. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, 498. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 62.

Owen's short description of this species is as follows:

"Hip. rostro antennis superioribus breviore, supra multi-serrato, ante medium subtus sex-serrato. Long. corp. 1½. Color ruber."

Rostrum shorter than the antennules, multi-serrate above, and armed below with six teeth in front of the middle. Length of the body 1½ inch. Color red.

Monterey (Owen).

There are several species of *Hippolyte* reported from Vancouver's Island by Professor Smith: viz., *H. Gaimardii* Milne-Edw.; *H. Grœnlandica*, under which are included *H. armata* and *H. cornuta* of Owen; *H. Phippsii* Kröyer, with which Smith unites *H. turgida* Kröyer, *H. vibrans* St. (♂ var.), and *H. ochotensis* Brandt; and *H. spinus*, which is now the type of Bate's genus *Spirontocaris*. All of these are circumpolar species, the western representatives of which I have not seen.

Another species of *Hippolyte* from Vancouver's Island has been described by Bate as *H. esquimaltiana*. It is not, however, a true *Hippolyte*, but the description is not sufficiently complete to enable one to determine just where it belongs. *Hippolyte sitchensis* Brandt has been reported from California by Stimpson, but a remark in Stimpson's description of *H. picta* discloses the fact that what he called *sitchensis* was probably another species. "*Picta*," says Stimpson, "differs from *H. sitchensis* in its longer external maxillipeds and non-carinated abdomen." It is certainly here implied that *sitchensis* has a carinated abdomen which, however, is not the case. Brandt in his description of that species says: "*Annulus abdominis tertius facie dorsali ecarinatus*," and further on that this species differs from *H. gibba* "durch den Mangel des Rückenkieles des dritten Bauchgürtels."

Heptacarpus, gen. nov.

Carapace carinated anteriorly and furnished with a dorsally serrated rostrum; the anterior margin is furnished with two spines, one just below the orbit, the other (generally the smaller) at the antero-lateral angle. No supraorbital spine. Ocular peduncles short, stout, single-jointed, and furnished with an ocellus on the posterior side. Antennules with a well developed outer basal spine; flagella two, a thick outer one terminating in a slender portion, and a slender (generally longer) inner one. Antennæ long, with a well developed scale, the outer margin of which ends in a spine. Maudibles strongly incurved, furnished with a slender apical process and a two-jointed palp. External maxillipeds devoid of an exognath. Anterior chelipeds stout, the carpus not excavated in front as in *Hippolyte;* hand oblong, the fingers ending in small curved claws or hooks. Second pair of chelipeds filiform; carpus seven-jointed; hand small and narrow. Posterior legs of subequal length; carpus produced distally over the propodus; propodi and dactyls spinulous below. Telson tapering and armed above with several pairs of spines. Branchiæ five.

Type.—*H. palpator* (OWEN).

Beside the characters mentioned in the diagnosis of the genus, all of the species I have seen agree in possessing the following features: There is a spine at the antero-external angle of the oblong first joint of the antennular peduncle and another spine on the lower margin of the inner side a short distance behind the distal end; the second joint of the peduncle has a spine on the outer side, and the third joint has a spine above the articulation of the thick flagellum, and there is generally a small spine above and internal to the articulation of the slender one. On the second joint of the antenna there is a blunt tooth above and a sharp spine below the outer edge of the scale. The tips of the external maxillipeds are armed with a circle of spines. The carpus of the anterior chelipeds has a short, transverse groove behind the inner distal margin.

Heptacarpus palpator *(Owen).*

Hippolyte palpator OWEN, Zool. Beechy's Voyage, 1839, p. 89, Pl. XXVIII, fig. 3. BRANDT in Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 117. STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 89; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 499. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 62. LOCKINGTON, *Ibid.*, Vol. X, 1878, p. 160.

? *Hippolyte Hemphillii* LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 35; Bull. Essex Inst., Vol. X, 1878, p. 160. KINGSLEY, *Ibid.*, Vol. X, 1878, p. 63.

Rostrum slender, horizontal, considerably shorter than the carapace and armed above with six teeth, the last two (or three) of which are on the carapace; the lower margin may be devoid of teeth, or there may be a small tooth near the tip. The outer basal spine of the antennules reaches nearly to the tip of the second joint of the peduncle; the upper distal margin of the first basal joint is armed with four spines, the spine at the outer angle being separated by a considerable interval from the other three which are close together. The spine above the articulation of the slender inner flagellum is very short; outer flagellum much shorter than the inner one. Antennal acicle tapering, longer than the telson; peduncle reaching about to the middle of the acicle which is in advance of the tip of the rostrum; flagellum often longer than the body. Mandibles with an oblong, thin, apical process which is armed at the distal end with several small teeth; palp two-jointed, about as long as the apical process behind which it normally lies. Maxillipeds very large, extending far beyond the tip of the antennal scale even in small specimens, while in adults the antepenultimate joint often reaches the tip of the acicle, the last joint extending beyond it for a distance greater than the length of the carapace; the outer margin of the antepenultimate joint is spinulous; last joint flattened, about four times the length of the preceding one and armed with a circle of spines at the tip and several smaller spines on the inner margin; there is a small epipodite but no exognath. Anterior chelipeds reaching considerably beyond the tip of the antennal scale; hand narrowly oblong. Second pair of chelipeds longer than the first; first joint of the carpus longer than the second; third joint longer than the first or fourth; fifth subequal to the fourth, longer than the sixth, which is much shorter than the seventh; hand about as long as the last three joints of the carpus. Posterior legs moderate, two or three spines on the outer side of the merus near the distal end; dactyls short, stout, about one-fourth the length of the propodi. All of the abdominal segments are rounded above; postero-lateral angles of the fourth segment rounded or subacute, having a small spine-tooth; those of the fifth segment acute and ending in a spine. Telson somewhat flattened above, where it bears four pairs of spinules; tip broadly rounded and furnished with a minute median spine between which and the spines at the outer angles there are on either side about four marginal setæ.

Monterey (Owen)! San Francisco Bay (Stimpson)! San Pedro! Santa Catalina Island! San Diego! Magdalena Bay (Lockington).

Brandt refers some specimens from Alaska to this species. He says: "Wosnesenski brachte von der Insel Kadjak vier Exemplare einer *Hippolyte* mit die durch die langen, aüsseren Maxillarfüsse und mehrere andere Kennzeichen *H. palpator* ungemein ähneln. Ich möchte sie daher vorläufig zu ihr ziehen, obgleich, abweichend von *palpator* der Thorax derselben oben zwei-bis dreizähnig, der Stirnschnabel oben meist zwei-, zuweilen einzähnig, unten zahnlos und nur so lang wie die Augen erscheint, wahrend die inneren Antennen die Deckschuppen der aüssern Fuhler deutlich überragen. Die grössten Individuen messen von der Stirn zur Schwanzspitze 2″, 4‴, die Lange des Thorax beträgt 9⅓."

I think it more probable that the species Brandt describes belongs to *H. brevirostris* (Dana) than to *H. palpator* (Owen). I have never seen any specimen of *palpator* attain nearly such a large size as the specimen measured by Brandt. The other characters mentioned by Brandt agree perfectly with *brevirostris*. The locality at which Brandt's specimens were taken also favors this supposition, as *brevirostris* appears to be a more northern species than *palpator*, having been taken as far north as Vancouver's Island (Smith).

Heptacarpus brevirostris *(Dana).*

Hippolyte brevirostris DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 24; Crust. U. S. Expl. Expd., Part I, 1852, p. 566, Pl. XXXVI, fig. 5. STIMPSON, Proc. Cal. Acad. Sci., Vol. I, 1856, p. 89; Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 500; Proc. Acad. Nat. Sci. Phila., 1860, p. 33. BATE, in Lord's Nat. in Vancouver's Is., Vol. II, 1866, p. 279. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 214. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 61. LOCKINGTON, *Ibid.*, Vol. X, 1878, p. 160.

Hippolyte palpator BRANDT, Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 117.

Spirontocaris brevirostris WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 276.

Allied to *palpator*, but larger and more robust. Carapace crested for a little more than its anterior third; rostrum short, not reaching the tip of the first joint of the peduncle of the antennules and armed above with five or six teeth, the last three or four of which are on the carapace, the posterior one being a little in advance of the middle; lower side of the rostrum devoid of teeth. The basal spine of the antennules reaches beyond the first joint of the peduncle; the spine above the articulation of the inner flagellum is very short; outer flagellum reaching beyond the antennal scale; inner flagellum about one-half longer than the outer. Antennal scale broad, short, about equal to the length of the telson; the peduncle extends about two-thirds the distance to the tip of the acicle. Maxillipeds very large, similar to those of *palpator*; in adults the tip of the antepenultimate joint may reach the tip of the antennal scale. The first pair of chelipeds often reaches beyond the acicle. The relative lengths of the joints of the carpus of the second pair are about the same as in *palpator*; hand as long as the last three carpal joints. Posterior legs stouter than in *palpator* but otherwise very similar. Postero-lateral angle of the fourth abdominal segment broadly rounded but furnished with a minute spine-tooth; that of the fifth segment acute. Telson dorsally flattened, having four or five pairs of spinules; tip rounded, wider than in *palpator*, and having several marginal setæ between the small median spine and the postero-lateral spines.

Length, 49 mm.; length of carapace, 16 mm.; of external maxillipeds, 32 mm.

Sitka (Brandt); Vancouver's Island (Smith); Puget Sound (Dana); Humboldt County, Calif.! San Francisco Bay (Stimpson)!

Differs from *palpator* in its larger, stouter body, shorter rostrum, much shorter and broader antennal scale, and stouter posterior legs.

Heptacarpus Taylori *(St.)*

Hippolyte Taylori STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 500. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 61. LOCKINGTON, *Ibid.*, Vol. X, 1878, p. 160.

A short, plump species very closely allied to *brevirostris*, but the rostrum is shorter, reaching but very little beyond the anterior margin of the carapace and armed above with five or six teeth, the last three or four situated on the carapace; the teeth become more closely set and more strongly inclined forwards anteriorly, the end of the rostrum appearing curved downwards, although the lower margin is nearly horizontal; there is but one spine on the upper distal margin of the first joint of the antennules; the telson is narrower than in *brevirostris*, and the distance between the small median spine at the tip and the spines at the postero-lateral angles is not nearly so great, and there are only one or two marginal setæ on either side of the apex, instead of four or five as in the preceding species. None of the specimens of *Taylori* I have seen attain nearly the size reached by *brevirostris*. The rostrum is rarely so long as in that species, and when it is so it maintains its characteristic appearance.

San Francisco Bay! Pescadero! Monterey! Magdalena Bay, Lower California (Lockington).

Although this species is very close to *brevirostris*, a comparison of several specimens of both species from different localities shows that they are distinct. *Taylori* is more southern in its range than *brevirostris*, but both species occur together in San Francisco Bay.

Heptacarpus pictus *(St.).*

Hippolyte picta Stimpson, Ann. N. Y. Lyc. Nat. Hist., Vol. X, 1873, p. 125. Kingsley, Bull. Essex Inst., Vol. X, 1878, p. 62.

A small species, less robust than *brevirostris* or *Taylori*. Rostrum slender, straight, horizontal or slightly upturned and about two-thirds the length of the carapace; upper margin with six or seven quite evenly spaced teeth, the last two of which are on the carapace; lower margin with two to four teeth near the tip. The tip of the peduncle of the antennules reaches the middle of the antennal acicle but not the tip of the rostrum; the outer basal scale of the antennules reaches beyond the first joint of the peduncle but scarcely reaches the tip of the second joint; no spines on the distal margin of the first basal joint except the one at the external angle; no spine above the base of the slender flagellum; outer flagellum reaching a short distance beyond the tip of the antennal scale; inner flagellum about one-half longer than the outer. The antennæ may exceed the length of the body; acicle oblong, slightly tapering, and generally exceeding the tip of the rostrum. Maxillipeds shorter and more slender than in *palpator*, but reaching beyond the tip of the rostrum even in quite small specimens; last joint in adults about four times the length of the preceding one. Anterior chelipeds not reaching the tip of the antennal scale. The first and second joints of the carpus of the second pair are subequal; third joint about equal to the first two combined; fourth joint subequal to (or somewhat shorter than) the third, longer than the fifth, which exceeds the sixth; seventh joint considerably longer than the sixth; hand shorter than the last three joints of the carpus. Posterior legs moderately stout; the distal portion of the outer surface of the merus joints armed with a row of spines, which in the first pair often extends more than half way to the base; dactyls short, stout, about one-fourth the length of the propodi, and armed below with spines, the largest of which are near the tip. None of the abdominal segments are carinated above; postero-lateral angle of the fourth abdominal segment obtuse but having a small tooth; that of the fifth segment acute and produced into a spine. Telson rounded above and armed with four or five pairs of spinules; a small median spine at the tip, between which and the spines at the lateral angles there are one or two marginal setæ.

Carapace beautifully marked with oblique crimson bands; legs barred with crimson, the dactyls and tips of the propodi light colored.

Monterey (Stimpson); Santa Catalina Island! San Pedro! San Diego!

This beautiful little species is commonly found in tide pools. It is abundant at Monterey and San Pedro on rocky shores.

Heptacarpus paludicola, sp. nov.

Closely allied to *picta*. Rostrum slender, horizontal, about as long as the carapace, armed above with 6–8 sharp, evenly spaced teeth, the last tooth on the anterior fourth of the carapace; lower margin armed with 2–4 teeth on the distal third or two-fifths. Antennular peduncle reaching two-thirds as far as the tip of the rostrum; basal spine extending beyond the tip of the first joint; upper distal margin of the first basal joint armed with a single spine at the outer angle. Antennal peduncle not reaching the middle of the acicle; acicle oblong, slightly tapering, closely resembling that of *picta*, and equalling the rostrum; flagellum as long as the body. Anterior chelipeds not reaching the tip of the acicle; hand narrow; palm fully as long as the carpus and about three times as long as wide. Second chelipeds about reaching the tip of the acicle; first joint of the carpus but little longer than the second, third and fourth subequal and each longer than the first, about equalling the fifth and sixth combined, fifth a little longer than the sixth and slightly shorter than the seventh; hand scarcely longer than the last two joints of the carpus. Posterior legs very slender; distal portion of the outer surface of the merus joints armed with a row of spines; dactyls short, about one-fourth the length of the propodi, narrower than in *picta* but similarly armed. Postero-lateral angles of the fourth abdominal segment subacute and furnished with a small tooth; that of the fifth segment acute. Sixth segment a little longer than in *picta*. Telson as in the preceding species. Color uniform green.

Humboldt Bay! Shelter Cove! Bodega Bay! June, 1894.

Large numbers of this species were caught in a trawl in the eel-grass in Humboldt Bay and Bodega Bay. The color is almost exactly that of the eel-grass in which they live. This species may be distinguished from *picta* by its larger size, different color, longer and more slender rostrum and the much more slender ambulatory legs. Collection University of California.

Heptacarpus cristatus *(St.).*

Hippolyte cristata STIMPSON, Proc. Acad. Nat. Sci. Phila., 1860, p. 33. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 62.
Spirontocaris cristata WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 277.

Less robust than *Taylori.* Rostrum rather narrow, about two-thirds the length of the carapace, arched over the eyes where the teeth are most thickly set, and armed above with 5-8 teeth, the posterior two or three being on the carapace, while the most anterior one is situated some distance behind the tip; lower margin with two or three teeth near the tip. The basal spine of the antennules reaches a little beyond the tip of the first joint. Antennal scale considerably longer than the rostrum and narrower than in *palpator* or *Taylori;* flagellum longer than the body. Maxillipeds reaching to or beyond the tip of the acicle; hand of the anterior chelipeds long and narrow. Second pair of chelipeds reaching the tip of the acicle; first joint of the carpus slightly longer than the second; third about as long as the first two; fourth, fifth and sixth decreasing successively in length; seventh longer than the fourth; hand nearly as long as the last three joints of the carpus. Posterior legs more slender than in *palpator*, the merus joints armed with spines on the distal portion of the outer surface; dactyls long, slender, evenly tapering, about half the length of the propodi. Abdomen moderate, none of the segments carinated above; postero-lateral angles of the fourth segment rounded but generally bearing a minute spine; those of the fifth segment acute and having a larger spine. Telson rounded above and having three pairs of dorsal spinules.

San Francisco Bay (Stimpson); Monterey! San Diego!

Easily distinguished from the other species described here by its long, slender dactyls.

Heptacarpus carinatus, sp. nov.

Carapace small in comparison to the abdomen; antennal spine well developed, larger than the spine at the antero-inferior angle. Rostrum rather narrow, evenly tapering, about equalling the carapace in length, the upper margin armed with 4–6 small teeth, the posterior one on the carapace, the anterior one a little behind the middle of the rostrum; lower margin armed with 4-6 teeth, the anterior tooth commonly near the tip. Ocular peduncles with an ocellus on the posterior side. The spine on the outer side of the base of the antennules reaches about to the tip of the first joint; antennal scale narrow, about equalling the length of the rostrum, the sides parallel, the inner, membranous portion projecting much beyond the outer distal spine; flagellum about as long as the body; the peduncle reaches about as far forward as the penultimate joint of the peduncle of the antennules. The external maxillipeds scarcely reach as far forward as the middle of the rostrum; last joint flattened, somewhat twisted, the tip armed with dark colored spines. The anterior chelipeds do not reach as far forward as the maxillipeds; hand thick at the base. Second pair of chelipeds reaching beyond the tip of the antennal peduncle; first and third joints of the carpus subequal and longer than the second; fourth and fifth joints subequal and shorter than the third; sixth joint the shortest of all; seventh about as long as the two preceding ones combined; hand narrow, the palm a little longer than the last joint of the carpus. Posterior legs rather stout, the extero-distal angles of the merus joints armed with 1-3 spines, the last pair seldom having more than one. The third segment of the abdomen is posteriorly produced and crested. Telson with four pairs of spines on the dorsal surface.

Dredged in large numbers in shallow water in Monterey Bay, November, 1895.

The color varies with the surroundings. Specimens among the bright green sea-weeds are of a uniform bright green color, while other specimens living only a few yards away among the red sea-weeds imitate almost exactly the color of the algæ that surround them.

Collection University of California.

Heptacarpus tenuissimus, sp. nov.

A very slender species. Anterior half of the carapace crested. Suborbital and antennal spines well developed. Rostrum longer than the carapace, horizontal and very slender, scarcely higher than wide, gently arching over the eyes, and armed above with four spines, the posterior spine on the carapace, the anterior one near the middle of the rostrum, the distal half of the upper margin being smooth; lower side of the rostrum with five teeth. Basal spine of the antennules scarcely reaching the tip of the first joint. Acicle long and narrow, about equalling the rostrum, the sides parallel; peduncle not reaching the middle of the acicle. Maxillipeds rather short. Anterior chelipeds scarcely reaching the tip of the antennal peduncle. The three posterior pairs of legs are slender and have short dactyls. Abdomen slender, the third joint rounded above but produced backwards in the middle. Telson narrow and armed above with seven pairs of minute spinules.

Length, 25 mm.

One specimen collected at Monterey by Dr. H. P. Johnson.

Easily distinguished from all the other species of *Heptacarpus* by its very slender, elongated body and very narrow rostrum. Collection University of California.

Heptacarpus Herdmani *(Walker)*.

Spirontocaris Herdmani Walker, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 277, Pl. XVI, fig. 2; Ann. Mag. Nat. Hist. (7), Vol. II, 1898, p. 276.

Carapace with a subocular spine and a small tooth at the antero-inferior angle. Rostrum horizontal, a little shorter than the carapace, the dorsal carina continued back upon the carapace nearly to the middle; "upper margin with five teeth, of which two are on the thorax, the second, third and fourth close together, the distance from the fifth to the point equal to the length from the second to the fourth. Lower margin with one tooth near the point." Maxillipeds reaching considerably beyond the tip of the acicle. First pair of legs reaching beyond the tip of the acicle, "the propodus as wide and more than twice as long as the carpus." "Abdominal segments having the lower margin rounded in the first four, acute in the fifth."

"One female with ova. Length, 30 mm."

Heptacarpus? stylus *(St.)*.

Hippolyte stylus Stimpson, Proc. Acad. Nat. Sci. Phila., 1864, p. 154. Kingsley, Bull. Essex Inst., Vol. X, 1878, p. 62.

Body slender. Carapace smooth, not crested, except for a short distance in front. Rostrum slender, styliform, perfectly straight and equal to the carapace in length; the upper side is armed with four or five teeth near the base, while the anterior two-thirds is devoid of teeth; lower side with five or six teeth. An antennal spine present but no supraorbital or pterygostomian spine. Antennal scale oblong, scarcely shorter than the rostrum and obliquely truncate at the end. Maxillipeds very small, reaching only to the end of the antennal peduncle, or to the basal third of the rostrum; there is an epignath but no exognath. None of the pereopods have an epipod. Telson with four pairs of spinules on the dorsal surface.

Length, 1½ inch.

Straits of Fuca (Stimpson).

Heptacarpus? Suckleyi *(St.)*.

Hippolyte Suckleyi Stimpson, Proc. Acad. Nat. Sci. Phila., 1864, p. 154. Kingsley, Bull. Essex Inst., Vol. X, 1878, p. 62.

Carapace with the anterior half crested and sloping forwards. An antennal and pterygostomian spine present but no supraorbital spine. Rostrum scarcely as long as the carapace, rather broad and curved, with a slender, acute tip; upper margin six-toothed, beginning at the anterior third of the rostrum; lower margin four-toothed. Maxillipeds reaching nearly to the tip of the acicle and devoid of an exognath or epignath. Pereopods long, the last pair nearly reaching the tip of the rostrum; first pair only provided with an epipod; dactyls of the last three pairs elongated, with only one terminal claw. Abdominal segments with smooth margins, the superior margin of the third segment obtuse.

Length, 1½ inch.

Puget Sound (Stimpson).

Heptacarpus? gracilis *(St.)*.

Hippolyte gracilis Stimpson, Proc. Acad. Nat. Sci. Phila., 1864, p. 155. Kingsley, Bull. Essex Inst., Vol. X, 1878, p. 62.

A slender species. Carapace crested on the anterior third. Rostrum very slender, scarcely higher than wide and a little longer than the carapace; the upper side is armed with four teeth over the eye, in front of which it is smooth to the tip; lower side armed with four minute distant teeth. An antennal and a pterygostomian spine present. The thick flagellum of the antennules reaches the tip of the rostrum. Acicle a little longer than the rostrum. The maxillipeds reach the middle of the rostrum and have no exognath. Pereopods very slender and devoid of an epipod. Abdomen very long and strongly geniculated, the third segment compressed and prominent, penultimate joint much elongated.

Length, 1¼ inch.

Puget Sound (Stimpson). Found in deep water.

Genus **Spirontocaris** *Bate*.

Carapace anteriorly carinated and produced into a deep, laterally compressed rostrum which is serrated on both margins. There are two or more supraorbital spines, an antennal spine, and a spine at the antero-inferior angle of the carapace. First and second antennæ much as in *Hippolyte*. Mandibles with a broad molar process, a slender apical process, and a small, two-jointed palp. Third maxillipeds furnished with a small exognath and having the tip of the last joint armed with spinules. First pair of pereopods short, robust; second pair slender, the carpus seven-jointed. Posterior pereopods subequal, similar, and furnished with biunguiculate dactyls which are spinulous below.

Type.—*S. spinus* (SOWERBY).

Spirontocaris prionata *(St.)*.

Hippolyte prionata STIMPSON, Proc. Acad. Nat. Sci. Phila., 1864, p. 153. KINGSLEY, Bull. Essex Inst., Vol. XIV, 1883, p. 127, Pl. II, fig. 9. SHARP, Proc. Acad. Nat. Sci. Phila., 1893, p. 117.
Spirontocaris prionata WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 277.

Carapace large, the anterior margin furnished with two spines, of which the upper one is the larger. There are two or three supraorbital spines in a longitudinal series; the upper side is crested nearly to the posterior margin and cut into three large teeth whose transverse anterior margins are armed on either side with several small spines. Rostrum very broad, widest a little behind the tip, the upper margin thickly set with small spines, while the lower margin is furnished with four or five larger spines. Antennules short, the external basal spine large, reaching about to the tip of the peduncle; the first joint of the peduncle is longer than the next two and has a spine at the antero-external angle; second joint with a large spine on the outer side; third joint with a slender spine above the articulation of the larger flagellum and a similar spine near the articulation of the slender one; thick flagellum longer than the slender one, with a slender tip about one-third the length of the proximal portion. Antennæ somewhat shorter than the body; acicle subtriangular, about reaching the tip of the rostrum; peduncle not reaching the middle of the acicle. Mandibles stout, cutting edge long, slender, distally four-toothed, and slightly longer than the palp; palp two-jointed, the last joint narrow and about twice as long as the first. Maxillipeds very stout and exceeding the tip of the rostrum, the last two joints bent downwards; the antepenultimate joint is somewhat widened at the tip where it bears, on the upper side, two small prominences, each of which bears a spine and numerous setæ; last joint over twice the length of the preceding one, the tip armed with a circle of dark-colored spines; exopod small, scarcely reaching the tip of the antepenultimate joint. First pair of chelipeds not reaching the middle of the antennal scale; hand oblong, thick, the tips of the fingers hooked. Posterior legs stout, setose; dactyls about half the length of the propodi. Abdomen short, contracted behind the fifth segment; all the segments are rounded above but the third is produced backwards in the middle into a rounded, triangular process; the postero-lateral angles of the fourth and fifth segments are produced into an acute tooth. Telson flat above where it is armed with four pairs of spinules; tip armed with two pairs of spines (the inner pair being the longer) and a short, median spine or tooth.

Puget Sound (Stimpson); Marmot Isles, Alaska (Sharp); Monterey!

Spirontocaris bispinosus, sp. nov.

Carapace with two supraorbital spines, a triangular tooth on the margin below the orbit, and a short distance below this a spine behind the base of the antenna; antero-inferior angle of the carapace with an obsolescent spinule. Rostrum a little longer than the carapace, strongly upturned, with the basal half high and laminate, but abruptly contracted near the middle into a slender, styliform process; the rostrum is continued backward over the anterior two-thirds of the carapace as a carina; the upper margin is armed with 10–12 teeth which decrease in size and become more closely set anteriorly, there being several small teeth crowded together where the rostrum is abruptly narrowed, the two posterior teeth on the carapace; distal half of the upper margin devoid of teeth; lower margin armed with three or four low teeth on the basal half and a single tooth on the slender process. Eyes pyriform with very large corneæ. Basal spine of the antennules reaching the middle of the second joint of the peduncle. Antennæ much longer than the body; acicle not nearly reaching the tip of the rostrum; peduncle reaching middle of acicle. Mandibles with a slender apical process; palp two-jointed, subequal to the apical process, the first joint broad; second joint narrow, about twice as long as the first. Maxillipeds not quite reaching the tip of the acicle; exognath slender, not nearly reaching the tip of the antepenultimate joint. First chelipeds rather slender, nearly reaching the tip of the antennal peduncle; carpus not distally excavated and longer than the palm of the narrow elongated hand. Second chelipeds exceeding the acicle, carpus seven-jointed, third joint longer than the first two. Posterior legs long and slender, merus armed externally with spines, dactyls very slender. All the abdominal segments are rounded above. Telson rounded above and armed with three pairs of dorsal spines.

Puget Sound, June, 1898, five specimens. Collection University of California.

Spirontocaris lamellicornis *(Dana).*

Hippolyte lamellicornis DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 24; Crust. U. S. Expl. Expd., Part 1, 1852, p. 567, Pl. XXXVI, fig. 6. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 498. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 62.

Spirontocaris lamellicornis WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 277.

"Beak long, broad, lamellate, produced nearly to posterior margin of thorax, bifid at apex, undulate above, four spines upon cephalothorax and about six upon proper beak, teeth or spines unequal, all nearly equally spaced; outline of beak below triangulately salient, two-dentate. Inner antennæ little longer than the beak. Anterior feet very slender, but little stouter than the next pair. Second pair hardly shorter than the third, carpus elongate, seven-jointed, third joint quite long. Tarsi of following pairs nearly unarmed, a few very minute spinules towards the base. Outer maxillipeds spinulous at apex, last joint pubescent above.

"Length of body one and one-half to two inches. The four dorsal spines are rather larger than those of the beak proper; and the first and last of the latter (not counting the bifid tip), are much smaller than the others; the outline of the whole is separately arcuate along the back and along the beak, with a concave outline between the two parts. The naked tarsus is peculiar. The base of the inner antennæ is hardly as long as half the beak, and the flagella scarcely reach beyond the tip of the beak. The second and third joints of the abdomen have the lateral margin triangulate or obtusely pointed, and in the next two this margin is acute. The third joint of the carpus of the second pair of feet is twice as long as the first and second joints together. The six posterior legs are nearly naked.

"Dungeness, in the Straits of De Fuca, Northwest America."

Species not seen.

Family PANDALIDÆ.

Rostrum long, slender and spiny. Eyes free. Mandibles with a two- or three-jointed palp. First pair of pereopods simple; second pair chelate, with the carpus annulated.

Genus **Pandalus** *Leach*.

Carapace smooth. Rostrum armed above and below with teeth and continued backward upon the carapace as a carina. Second pair of pereopods with the carpi unequal and multiarticulate.

Type.—*P. annulicornis* LEACH.

Pandalus Danæ *St.*

Pandalus Danæ STIMPSON, Proc. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 87; Journ. Bost. Soc. Nat. Hist., Vol. VI, p. 502, Pl. XXI, figs. 6 and 7, 1857. COOPER, Rep. Expl. and Sur. to Pac. Ocean, Vol. XII, Book 2, 1860, p. 389. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 64. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 214. RATHBUN, R., The Fisheries of the U. S., Sec. 1, 1884, p. 821. SHARP, Proc. Acad. Nat. Sci. Phila., 1893, p. 115.

Rostrum slender, about as long as the carapace and quite strongly upturned; upper margin armed with 10–12 sharp teeth, the posterior five of which are on the carapace, the last one a little behind the middle, the anterior half of the upper margin of the rostrum smooth; apex trifid; lower margin armed with six or seven teeth which decrease in size anteriorly, the posterior tooth large and curved strongly forwards. Subocular spine well developed; antennal spine small. The appendage on the outer side of the basal joint of the antennules is small, lamellate, rounded at the tip and not reaching as far as the middle of the joint; inner flagellum longer than the outer one. Antennal scale narrow, tapering, not nearly so long as the rostrum; two spines on the outer side of the second joint of the peduncle; flagellum longer than the body. The maxillipeds do not reach the tip of the rostrum and may fall short of or exceed the tip of the acicle. First pair of legs shorter than the maxillipeds, the merus produced forwards at the infero-distal angle into a spine. Second pair elongated, very unequal, the longer member with a sharp crest on the inferoproximal portion of the ischium; the merus and distal end of the ischium are closely annulated; carpus very long, slender, divided into very numerous annulations and channeled along one side; hand oblong, narrow, the fingers scarcely as long as the palm; the shorter cheliped is variable in length, exceeding or not equalling the tip of the rostrum; the ischium is not distally annulated and the merus is obscurely annulated, but the annulations of the carpus are distinct; hand similar to that of the longer cheliped. The three following pairs of legs are spinous and rather stout, decreasing in length posteriorly, the dactyls short and spinulous below. The postero-lateral angle of the fifth abdominal segment is rounded, but furnished with a minute tooth; that of the fifth segment subacute and furnished with a similar tooth. Telson a little shorter than the uropods, furnished with a shallow superior groove, at the proximal end of which is a small tuft of hairs, and armed above with seven or eight pairs of spinules.

Length, 124 mm.; length of carapace including rostrum, 58 mm.; rostrum, 30.5 mm.; left cheliped, 67 mm.; right cheliped, 42 mm.; third pereopods, 65 mm.

Alaska (Sharp); Vancouver's Is. (Smith); Puget Sound (Cooper); San Francisco Bay (Stimpson)!

Pandalus pubescentulus *Dana.*

Pandalus pubescentulus DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 24; Crust. U. S. Expl. Expd., Part 1, 1852, p. 568, Pl. XXXVI, fig. 8. STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 501. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 63. SMITH, Rep. Prog. Geol. Sur. Canada, 1878-9, *B*, p. 214.

"Carapax densely very short pubescent, margin below the eye with two spines. Beak longer than the basal scale of outer antennæ; ensiform, somewhat recurved, but apex not raised above level of back, 16-18 toothed above, teeth small and continued nearly to middle of back, towards apex unarmed, apex bifid, below seven-toothed. Feet nearly naked, third, fourth and fifth pair decreasing regularly in length, anterior pair but little longer than the first three joints of second pair.

"Length of body, 5 inches; of carapax, 2¼ inches; of beak to the posterior tooth on the back, 1⅝ inches; of beak to the orbital sinus, its proper base, 1¼ inches.

"Straits of De Fuca, at Dungeness, Oregon."

This species has been reported from Vancouver's Is. by Smith.

Pandalus Gurneyi *St.*

Pandalus Gurneyi STIMPSON, Ann. N. Y. Lyc. Nat. Hist., Vol. X, 1873, p. 128. KINGSLEY, Bull. Essex Inst., Vol. X, 1878, p. 63.

"A large species, of the same size as *P. borealis*, etc. Surface of the carapax marked with shallow pits in clusters; not pubescent. Rostrum more than one-half longer than the carapax and unarmed above, except near the base, where the crest has eight or nine teeth, four of which are on the carapax; these teeth are small and rather distant. Below the rostrum is armed with nine teeth, the two teeth next the base being rather

close together, large, and hook-shaped, but not broad. The feet of the third pair are rather short, not reaching the extremity of the rostrum; they terminate in well-formed, subcheliform hands.

"Found at Monterey, Calif., by A. S. Taylor, Esq."

Pandalus franciscorum *Kingsley.*

Pandalus franciscorum **KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1878, p. 94; Bull. Essex Inst., Vol. X, 1878, p. 63.**

"Carapax with a minute pubescence; antennal and branchiostegal spines acute; rostrum a fifth longer than the carapax, extending a fourth its length beyond the antennal scales, considerably recurved, ten or eleven teeth above, of which five are on the carapax and the remainder on the basal portion of the rostrum; distal half of the rostrum above smooth, the apex being minutely bifid or trifid; below with seven to nine teeth, the posterior being the largest. Third joint of the antennular peduncle a third longer than the preceding; flagella about as long as the carapax. Basal joint of the antennæ with a spine on the outside and another below; antennal scale long and proportionately narrower than in *P. borealis* Kröyer; flagellum longer than the body. External maxillipeds falling short of the extremity of the antennal scale. Second pair of feet unequal, the shorter extending further forwards than the external maxillipeds. Posterior pairs stout, armed with spines below. Fifth and sixth abdominal segments with a spine at the infero-posterior angle. Telson narrow, a shallow furrow on its upper surface, apex obtusely triangular.

"Length, 110 mm.; carapax, 52 mm.

"San Francisco, Calif., W. G. W. Harford."

Family ATYIDÆ.

Mandibles stout and divided, but not deeply so, and devoid of a palp. First two pairs of pereopods chelate, the tips of the fingers furnished with hairs. Rostrum variable. Fresh water forms.

Syncaris, gen. nov.

Carapace not carinated in front and armed with supraorbital and antennal spines. Rostrum long and slender, armed with teeth on one or both sides, and rounded above at the base. Antennules biflagellate, the outer flagellum with a thickened basal portion. External maxillipeds furnished with an exognath. Two or more pairs of pereopods furnished with exopods. First pair of chelipeds short and rather stout; carpus short and

distally excavated to receive the propodus. Second pair of chelipeds longer and more slender than the first, the carpus long and not distally excavated. The three following pairs of pereopods are longer than the chelipeds; dactyls very short and spinulous below. All the abdominal segments rounded above. Tip of the telson truncated or broadly rounded.

Type.—*S. pacifica* (HOLMES).

This genus is intermediate between *Atyephyra* and *Xiphocaris* as defined by Ortmann.[1] The latter genus, according to Ortmann, contains besides the type, *X. elongata*, the *Ephyra ? compressa* of De Haan which Von Martens had placed in *Atyephyra* and for which Miers had constituted provisionally the genus *Paratya*. Mr. Ortmann recognizes but one species of *Atyephyra*, viz., *Desmarestii* (the *Caridina Desmarestii* of Joly), which Brito Capello described as *Atyephyra rosiana*, making the new genus *Atyephyra* to receive it. *Desmarestii* being generically distinct from *Caridina* in the strict sense becomes, therefore, the type of *Atyephyra*. Our two species differ from *A. Desmarestii* in not having the carpus of the second pair of pereopods distally excavated, in having the anterior part of the carapace rounded above instead of armed with a dentate carina and in having a prominent suborbital spine. *S. Trewi* approaches *Atyephyra*, however, in having exopods only on the first two pairs of pereopods instead of the first four as in *pacifica*. From *Xiphocaris elongata* both of our species differ in having supraorbital spines, in the less number of exopods, and in having the carpus of the first pair of chelipeds excavated. They approach more nearly *X. compressa* (De Haan), for in that species supraorbital spines are present, though there are exopods on all the pereopods, and the carpus of the anterior chelipeds is not hollowed out.

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[1] Proc. Acad. Nat. Sci. Phila., 1894, p. 399.

It was owing to the affinities of my *pacifica* with *X. compressa* (De Haan) that I was led to put the former species in the genus *Miersia*, the *Ephyra? compressa* (De Haan) having been placed in *Miersia* in Kingsley's revision of the genera of the Atyidæ. Mr. Kingsley, however, was wrong in referring *compressa* to *Miersia*, for, as Bate has pointed out, the type of that genus, *M. pelagica*, is marine and belongs properly in a different family.

Syncaris pacifica *(Holmes).*

Miersia pacifica Holmes, Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 577, Pl. XXI, figs. 27 and 28.

Rostrum slender and about as long as the carapace; upper margin armed with one or two spines, the lower with 5–9 spines. A pair of supraorbital spines. Antennular flagella subequal, the outer one with a thickened basal portion. Antennal scale reaching about to the tip of the rostrum. All the pereopods except the last pair furnished with exopods. The first pair of legs is short, the carpus short and distally widened, the end excavated to receive the basal prominence of the palm. Second pair of legs longer than the first; carpus longer than the hand. The three following pairs are subequal; dactyls short. Telson tapering to a truncated or broadly rounded tip.

Length, 5 cm.

Sonoma County, Calif., (L. E. Ricksecker coll.) Types in the Museum of the California Academy of Sciences.

Syncaris Trewi, sp. nov.

Carapace with supraocular and subocular spines; a tooth at the antero-inferior angle. Rostrum slender, slightly upturned, and about one-half the length of the carapace; the upper side is rounded and devoid of teeth, the lower margin armed with 3–5 teeth on its distal half. The basal spine of the antennules reaches slightly beyond the tip of the first joint; flagella subequal and about as long as the carapace exclusive of the rostrum; the basal third of the outer flagellum is markedly thicker than the distal portion. Antennæ nearly as long as the body; acicle oblong, about equalling the rostrum, sides nearly parallel, tip broadly rounded and projecting considerably beyond the spine at the end of the outer margin. Maxillipeds not reaching the tip of the rostrum, the exognath not reaching the tip of the penultimate joint. Anterior chelipeds short; carpus short and excavated to receive the propodus. Second pair of chelipeds much longer than the first, carpus much longer than the hand and not distally excavated. The succeeding pereopods are longer than the chelipeds; merus and carpus with a few spines on the outer side; dactyls of the first two pairs about one-fourth the length of the propodi and armed below with numerous spines; dactyls of the last pair longer than those of the preceding pairs and of a different shape, the lower margin finely pectinated nearly to the terminal claw behind which are two spines. Telson rounded above and tapering to a broadly rounded or truncated extremity; upper surface armed with two pairs of short spines. Uropods longer than the telson.

Length 1.5 in.

Described from four specimens collected in a small stream near San Gabriel, Los Angeles County, Calif., by Mr. N. C. Trew. All the exopods in some of the specimens were broken off, but in others they were present on the first two pairs of pereopods. I have found no trace of exopods on any of the posterior pairs; they may have been present and become broken off but I do not think this is probable. Collection University of California.

Genus **Caridina** *Milne-Edwards.*

Carapace with a well developed rostrum. Pereopods devoid of exopods. Carpus of the first exopods distally excavated; that of the second pair not excavated.

Type.—C. typus MILNE-EDWARDS.

Caridina pasadenæ *Kingsley.*

Caridina pasadenæ KINGSLEY, Bull. Essex Inst., Vol. XXVII, 1897, p. 98, Pl. III, figs. 1-7.

Carapace not carinated anteriorly and furnished with a suborbital and an antennal spine. Rostrum three-fourths the length of the carapace, smooth above, bifid at the apex, and occasionally armed with a single tooth on the lower margin. Basal scale of the antennules reaching slightly beyond the tip of the first joint; inner margin of the first joint armed with a small spine. Antennæ about two-thirds the length of the body; acicle narrow, reaching slightly beyond the tip of the antennular peduncle. Exognath of the external maxillipeds slender, not reaching the tip of the merus. First chelipeds short, rather stout; second pair twice the length of the first, the carpus much longer than the hand. Posterior pereopods elongated, dactyls curved, spinulous below.

Length, 32-39 mm.

From streams near Pasadena, Calif., where it is said to be common. This species bears some resemblance to the form from near the same locality which is here described as *Syncaris Trewi*. It differs from the latter in having fewer teeth on the lower side of the rostrum, and, according to Kingsley's fig. 1, in the absence of a supraorbital spine. Kingsley's fig. 6, which represents a mandible with a two-jointed palp, probably refers to the mandible of *Naushonia* and not, as is stated in the explanation of the figures, to that of *Caridina*.

Family PALÆMONIDÆ.

Body compressed. Carapace dorsally rounded and furnished with a long, laterally compressed rostrum which is generally armed with teeth. Ocular peduncles well developed. Antennules with the first joint hollowed on the upper surface and furnished with a well developed basal spine; flagella two, one of which is frequently branched. Antennæ long, with a long acicle, the outer margin of which terminates in a tooth or spine. Mandibles with a molar tubercle and a cutting edge, with or without a palp. Third maxillipeds pediform. First two pairs of pereopods chelate; the carpus of the second pair not annulated.

Genus **Palæmon** *Fabr*.

Rostrum long, deep, dentate above and below. Frontal margin of the carapace armed with two teeth, the one above the other. No hepatic spine. Ocular peduncles pyriform and provided with an ocellus. Antennules with two long flagella, the outer one branched. Mandibles with a three-jointed palp. External maxillipeds slender, with a short exognath. First pair of chelipeds slender; second pair larger than the first; the carpus elongated.

Palæmon Ritteri *Holmes.*

Palæmon Ritteri HOLMES, Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 579, Pl. XXI, figs. 29–35.

Carapace crested on the anterior third or half. A spine beneath the angular suborbital projection of the anterior margin of the carapace and another spine behind the base of the antenna and above the rounded inferior angle. No hepatic spine. Rostrum a little longer than the carapace, tapering gradually from the widest portion to the acute tip; upper margin armed with seven or eight teeth, the posterior one of which is situated on the gastric region; lower margin with three teeth. Antennal scale oblong, shorter than the rostrum. First pair of chelipeds slender, not reaching beyond the tip of the rostrum; carpus devoid of a spine; hand slender. Second pair somewhat larger than the first; carpus not half as long as the preceding joint; hand linear and slightly bent.

Length, 4.5 cm.

San Diego, Calif. (Dr. Ritter).

Genus Anchista *Dana.*

Rostrum long and slender. Eyes prominent. Antennules with one flagellum partly divided. Mandibles devoid of a palp. External maxillipeds slender. Second pair of pereopods long, slender and equal. Dactyls slender, long, and nearly straight.

Type.—A. gracilis DANA.

Anchista tenuipes, sp. nov.

Rostrum about as long as the carapace, rather deep near the middle, armed above with six or seven teeth, the last one or two on the carapace; lower side armed with three or four teeth; the last dorsal spine is near the anterior third of the carapace. A supraorbital, an antennal and a hepatic spine present; antero-lateral angle of the carapace rounded and devoid of spines. Ocular peduncles large and furnished with an ocellus between the cornea and the proximal part of the stalk. Antennular peduncle shorter than the antennal scale; first joint with a small spine at the antero-external angle, the basal spine small, not reaching the middle of the joint; second and third joints of subequal length; flagella longer than the peduncle, the lower one very slender. Antennæ about as long as the body; a spine on the outer angle of the second basal joint; acicle oblong, equalling or exceeding the rostrum. Maxillipeds slender, not nearly reaching the tip of the acicle; exognath reaching considerably beyond the antepenultimate joint. Anterior pereopods very slender, and reaching scarcely beyond the carpus of the second pair; carpus slightly longer than the merus; hand very narrow, shorter than the carpus; fingers straight, subequal to the palm. Second pair of pereopods slender and greatly elongated, the carpus reaching beyond the rostrum; ischium, merus and carpus of subequal length, the latter furnished with two teeth at the distal end; hand long, very narrow, subcylindrical, exceeding the length of the carpus and merus combined; fingers slender, straight, about two-thirds as long as the palm, the tips hooked and crossed when the fingers are closed. The ambulatory legs are very slender, nearly naked, and subequal. The postero-lateral angle of the fifth abdominal segment is rounded, that of the sixth acute. Telson with two pairs of dorsal spinules.

Length of body, 18 mm.; of second chelipeds, 16 mm.; of hand, 7 mm.; of carpus, 3 mm.

Santa Catalina Island, August, 1893; three specimens.

Closely allied to *A. ensifrons* Dana from north of Borneo, but is distinct. Collection University of California.

Subtribe PENÆIDEA.

Gills dendrobranchiate. Third pair of pereopods and frequently the first and second pairs chelate; the first pair never very large and stout, usually smaller than the others. Fourth and fifth pairs of pereopods always devoid of chelæ.

Family PENÆIDÆ.

Carapace generally compressed and produced backwards at the sides. Rostrum compressed and usually continued back upon the carapace as a carina. Eye-stalks generally two-jointed. Antennules biflagellate; first basal joint with an external spine and an unjointed appendage on the inner side; upper surface excavated. Antennæ long, with a large acicle. Mandibular palp never more than two-jointed. Third maxillipeds long and pediform. First three pairs of pereopods chelate and similar. Abdomen long and compressed, more or less carinated above; the sides of the first segment produced so as to overlap the sides of the carapace in front and those of the second segment behind.

Genus **Penæus** *Fabr.*

Body strongly compressed. Rostrum prominent, serrated. Eye-stalks two- or three-jointed. Flagella of the antennules not longer than the carapace. Mandibular palp two-jointed. First three pairs of pereopods chelate and furnished with small exopods and increasing in length posteriorly. No podobranchiæ. All the abdominal appendages bear two foliaceous branches except the last pair which, in the male, carries attached to the base a large, membranous appendage, which in the female is reduced to a rudiment.

Penæus californiensis, sp. nov.

Penæus canaliculatus HOLMES (not OLIVIER), Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 581.

Rostrum slender, acuminate, slightly arched, the upper margin ciliated and armed with nine or ten teeth, the last tooth on the gastric region and separated by an unusually wide interval from the preceding tooth; lower margin with two small teeth; the rostrum is continued backward upon the carapace as a carina nearly to the posterior end, its dorsal surface sulcate posterior to the last tooth; on either side a prominent groove which terminates abruptly a short distance in front of the posterior margin of the carapace; the outer margins of these grooves spread outward near the last rostral tooth and are continued anteriorly upon the lateral ridges of the rostrum. Above the base of the antennæ there is a strong marginal spine which is continued backwards into a carina; above this is a wide, oblique groove, at the posterior end of which is a small hepatic spine; a narrow groove, running obliquely downwards, joins the wide groove immediately above this spine. Antero-lateral angle of the carapace rounded, with a sinus above. Antennular peduncle equalling or a little exceeding the rostrum, the inner appendage of the first joint long, narrow and ciliated; flagella much shorter than the peduncle. Antennal scale reaching about as far forward as the tip of the rostrum; the flagellum may exceed the length of the body. Chelipeds becoming more slender posteriorly and increasing in length, owing mainly to the increase in the length of the carpus; the second joint in the first two pairs has a spine at the distal end of the lower margin, and there is a second spine in the first pair on the lower side of the ischium; the chelæ become longer and narrower posteriorly; the first is nearly as long as the carpus, while the third is scarcely half as long as that joint; two posterior pairs of pereopods subequal. The three anterior abdominal segments are not carinated above; the fourth is carinated at least on the posterior portion; fifth segment carinated, but not ending posteriorly in a tooth; the carina on the sixth segment is acute, with a groove on either side, and terminates in a tooth at the posterior end. Telson acute, about as long as the preceding segment, devoid of lateral spines, and furnished with a conspicuous dorsal groove, which extends from the anterior end to the tip. The uropods extend far beyond the telson.

Length from tip of rostrum to tip of telson, 182 mm.; rostrum, 24 mm.; carapace including rostrum, 41 mm.; acicle, 27 mm.; external maxillipeds, 45 mm.; first chelipeds, 35 mm.; carpus and hand of same, each 8 mm.; carpus of second chelipeds, 14 mm.; hand of same, 9 mm.; carpus of third chelipeds, 23 mm.; hand of same, 10.5 mm.; sixth abdominal segment, 25 mm.; height of same, 19 mm.

Specimens examined, one male from near Anaheim, Calif., and two specimens, male and female, from San Francisco Bay.

Closely allied to *P. braziliensis* but having shorter and stouter legs. This species is also closely allied to *canaliculatus*, but, so far as I can obtain information concerning the latter species, our California forms differ from it in having a tooth at the posterior end of the sixth abdominal segment, in having the longitudinal ridges on the carapace spreading somewhat in the middle instead of running parallel; the anterior chelipeds are a little shorter than Bate's figure represents them to be in the typical form of *canaliculatus*. Possibly the California forms will later be connected with *braziliensis* or *canaliculatus*, but it is best, I believe, at present to regard them as forming a distinct species. Collection California Academy of Sciences.

Suborder STOMATOPODA.

Carapace small, leaving the last three or four segments of the thorax uncovered. Rostrum separated from the carapace by a movable joint. Eye-peduncles situated like the antennules on a movable segment. First five pairs of thoracic appendages not biramous, the second pair large and chelate, last three pairs biramous and gressorial. Abdomen large, generally depressed; the first five pairs of pleopods with external gills. Uropods large and forming with the telson a strong tail-fin.

Genus **Pseudosquilla** *Dana*.

Abdomen smooth and strongly convex above, the sixth segment not fused with the telson. Telson with well developed submedian spines with movable tips, and one to four intermediate denticles between the submedian and intermediate spines. The dactyl of the large chelipeds is not strongly dilated at the base and has few or no marginal spines.

Pseudosquilla Lessonii *(Guerin).*

Squilla Cerisii GUERIN, Voy. Coquille, Crust., 1830, p. 40 (*S. Lessonii* on plate).
Squilla spinifrons OWEN, Proc. Zool. Soc. London, 1832, p. 6.
Squilla Lessonii MILNE-EDWARDS, Hist. Nat. Crust., Tome II, 1837, p. 527. WHITE, List. Crust. Brit. Mus., 1847, p. 84.
Squilla monoceros MILNE-EDWARDS, Hist. Nat. Crust., Tome II, 1837, p. 526. NICOLET in Gay's Hist. Chile, III, Crust., 1849, p. 224.
Pseudosquilla Lessonii DANA, Crust. U. S. Expl. Epd., Part 1, 1852, p. 662. MIERS, Ann. Nat. Hist. (5), Vol. V, 1880, p. 113. BIGELOW, Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 502.
Pseudosquilla marmorata LOCKINGTON, Proc. Cal. Acad. Sci., Vol. VII, 1877, p. 33.

Rostrum with acute outer angles and a long, median spine. Hand with three marginal spines; finger with two spines near the base. Sixth abdominal segment with four longitudinal carinæ which end posteriorly in spines. Telson with a median carina which ends posteriorly in a spine and five smaller carinæ on either side; the posterior margin has three large spines on either side of the triangular, median notch; two spinules between the submedian spines and the next large spine in front; a single spinule between the following pair of large spines. Basal prolongation of the uropod ending in one large spine with two spines on its inner margin; outer margin of the outer ramus of the uropods armed with spines which increase in size posteriorly, the last spine much exceeding the preceding ones.

Chili, S. lat. 00° 46′; W. lon. 89° 42″; Wilmington, Calif. (Bigelow); Lower California; San Diego (Lockington)! Santa Catalina Island!

Pseudosquilla stylifera *(M.-Edw.).*

Gonodactylus styliferus MILNE-EDWARDS, Hist. Nat. Crust., Tome II, 1837, p. 530. NICOLET in Gay's Hist. Chile, III, Crust., 1849, p. 225.
Pseudosquilla stylifera MIERS, Ann. Nat. Hist. (5), Vol. V, 1880, p. 112. BIGELOW, Proc. U. S. Nat. Mus., Vol. XVII, 1894, p. 502, fig. 3.

Rostrum longer than broad, acute, but not ending in a spine. Dactyl of the large chelipeds devoid of spines. Sixth abdominal segment longitudinally carinated. Telson with a median carina and a lateral one on either side; posterior margin with three large spines on either side of the median notch; a rounded denticle between the submedian and intermediate spines.

Chili; San Pedro (Bigelow); Santa Catalina Island! Point Mendocino, Calif.!

Suborder SCHIZOPODA.

Carapace rather small and generally not covering all the segments of the thorax. Eyes stalked. Mandibles generally furnished with an elongated palp. Maxillipeds similar to the succeeding appendages of the thorax which are furnished with well developed exopods. Ova carried beneath the thorax, with or without marsupial plates. Tail-fin well developed.

Family MYSIDÆ.

Carapace small and membranaceous. Pereopods generally of similar form and slender. Branchiæ entirely absent. Females with a marsupial pouch. Pleopods generally rudimentary in the female and often so in the male. Inner ramus of the uropods usually furnished with an auditory organ.

Genus **Mysis** *Latr.*

Body slender. Antennal scale setose on both sides and not ending in a spine. Thoracic legs with the propodi subdivided. Fourth pair of pleopods in the male with the outer ramus greatly elongated; third pair of pleopods generally unlike those of the female, the remaining pairs simple and rudimentary as in the other sex.

Type.—M. oculata FABR.

Mysis costata, sp. nov.

Rostrum broadly triangular, ending in a spine. Ocular peduncles short, stout, and slightly flattened horizontally. First joint of the antennular peduncle about one-half longer than wide; second joint very short; outer flagellum about twice as long as the inner one and furnished with a few long setæ near the base; the sensory organ of the male is well developed and furnished with a large, dense tuft of long curved hairs. Peduncle of the antennæ reaching about to the middle of the acicle but not reaching the tip of the peduncle of the antennules; second joint with a spine external to the base of the acicle; acicle narrow, tapering slightly towards the narrowly rounded tip and ciliated on both margins. Trunk of the mandibles very short and thick; penultimate joint of the palp widest a short distance from the base, whence it tapers to the distal end; second joint narrow, shorter than the preceding one, thickly setose, and having a large, curved, claw-like seta at the tip. The three pairs of maxillipeds end in a claw, the last joint of the third pair five-jointed; the propodi of the succeeding thoracic appendages are 5-7-jointed and end in a claw. Pleopods of the female simple and rudimentary. First three pairs of pleopods in the male simple and rudimentary, as in the female, and of similar form and nearly equal size; fourth pair with the exopod long, slender, smooth and curved, extending backwards beyond the tip of the sixth abdominal segment, the endopod short and furnished with long, plumose setæ; fifth pair of pleopods similar to, but slightly longer than the first three pairs. Telson very narrowly triangular, channeled above, and tapering to the narrow tip which is armed with strong spines; the margins are armed with strong spines, between which are several smaller ones. Inner caudal lamella narrow, widened at the base where the auditory organ is situated, rounded at the tip, and about equalling the telson; outer lamella about one-fourth longer than the inner one. The first abdominal segment is crossed with three and the following segments with two transverse ridges; first ridge on the sixth segment with a prominent median spine, second ridge with a pair of small median spines, and at the posterior margin of the segment there is a small median spine with a rounded lobe on either side. Two pairs of marsupial lamellæ.

Length, 10 mm.

Numerous specimens taken in a tow net at San Pedro, Calif., July, 1896.

Collection University of California.

Genus **Neomysis** *Czerniavsky.*

Very closely allied to *Mysis*, from which it differs in having the long, narrow, antennal scale, which is setose on both margins, end in a sharp spine.

Type.—N. vulgaris (THOMPSON).

Neomysis mercedis *Holmes.*

Neomysis mercedis HOLMES, Proc. Cal. Acad. Sci. (2), Vol. VI, 1897, p. 199, Pl. XIX, figs. 1-10.

Rostrum rounded. Acicle narrow, elongated, tapering gradually to an acute tip, and furnished with thickly set, plumose setæ on both margins.

The distal portion of the thoracic legs is divided into 8–10 setiferous articulations, the last joint furnished with a claw. In the fourth pair of pleopods in the male the endopod reaches about to the middle of the slender, elongated exopod; terminal joint of the exopod short and bearing two large, sparingly plumose setæ at the tip. Telson triangular, tip slightly emarginate, margins armed with several spines. Inner ramus of the uropods widened at the base and tapering to an acute tip which reaches beyond the telson; outer ramus much longer than the inner one, the sides subparallel to the rounded tip.

Almost colorless, with the exception of several large, irregularly branching pigment spots.

Lake Merced, Calif. Collected by Dr. H. P. Johnson.

Neomysis franciscorum, sp. nov.

Anterior margin of the carapace produced forwards into a wide quadrate lobe with a straight anterior margin and rounded angles. A strong spine at the antero-lateral angles of the carapace, above which the margin is concave. Eye-peduncles large and pyriform. Antennular peduncle reaching about one-third the length of the acicle. First joint of the antennæ with a spine at the antero-external angle; peduncle one-fourth the length of the acicle, which is very narrowly lanceolate and ciliated on both margins. Epistome produced anteriorly into a spine. Last joint of the mandibular palp narrow and somewhat shorter than the preceding one which is much widened. Thoracic legs similar, the propodi divided into from ten articulations in the first, to fourteen in the last pair. All the pleopods in the female short and simple. Telson narrow, concave above, and tapering evenly to a point, the margins armed with numerous spines. Inner uropods narrow, tapering to an acute tip, and about equalling the telson.

Length, 1.25 in.; length of carapace, $\frac{5}{16}$ in.; of telson, $\frac{5}{16}$ in.

A single specimen taken in San Francisco Bay.

This species is closely allied to *Neomysis Rayii* (Murdoch) from Point Barrow, but differs in having the telson acute instead of "truncated," and in having the terminal portions of the thoracic legs divided into a greater number of articulations. Collection University of California.

Genus **Callomysis** *Holmes.*

Carapace with rounded angles and a deep posterior emargination. Antennal scale oblong, the outer margin naked and ending in a spine; inner and distal margins ciliated. Distal portions of the thoracic legs divided into numerous articulations. Pleopods in the female rudimentary but biramous; pleopods in the male short and small except the third pair, the outer ramus of which is much elongated. Telson armed with lateral spines and having a spinous emargination at the tip.

Type.—C. maculata HOLMES.

Callomysis maculata *Holmes.*

Callomysis maculata HOLMES, Proc. Cal. Acad. Sci. (2), Vol. IV, 1895, p. 582, Pl. XXI, figs. 37–44.

Rostrum subtriangular. Last joint of the peduncle of the antennæ about as wide as long; acicle oblong, shorter than the peduncle, the tip truncated. Maxillipeds (first thoracic appendages) with the exopod longer than the endopod, the terminal portion divided into about fifteen articulations; the following pair of appendages much like the preceding but with a longer exopod; the endopods of the remaining pairs are longer than the exopods and have the terminal portion divided into 10–13 articulations. Pleopods rudimentary in the female, the rami of the first pair subequal; in the following pairs the outer ramus is minute. In the male the inner rami are shorter than the outer, the exopod of the third pair very long and slender; fourth and fifth pairs subequal and a little shorter than the first two pairs. Telson oblong, the sides armed with about eight strong spines; apical emargination with several slender spines. Uropods subequal and scarcely exceeding the telson. Nearly transparent, with large black pigment spots having numerous, irregularly branching radiations.

Length, 15 mm.

Trinidad, Calif.; taken on a sandy beach in which the animals burrow as the waves recede. The females taken in June had their marsupial pouches filled with eggs or larvæ.

Genus **Heteromysis** *Smith.*

Body comparatively short. Carapace emarginate behind, not covering all the segments of the thorax. Eyes small. Antennal scale small, lamelliform, with both margins setose. Third maxillipeds much larger than the following appendages, propodal joint entire and spinous, terminal joint unguiform; the remaining legs slender, the terminal portion multiarticulate and devoid of a claw. Pleopods in both sexes small, simple, and similar. Telson deeply cleft at the apex.

Type.—*H. formosa* SMITH.

Heteromysis odontops *Walker.*

Heteromysis odontops WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 278, Pl. XV, figs. 3–6; Ann. Mag. Nat. Hist. (7), Vol. II, 1898, p. 276.

Body rather slender; rostrum subacute. Eyes stout, with a tooth on the distal end of the anterior margin of the peduncle. Legs behind the second pair with a terminal segment divided into eight articulations. Telson with the lateral margins slightly concave and armed with about twenty-four spines which extend over the whole length; tip of the telson with a deep, narrowly triangular cleft whose sides are armed with about thirty rather long spines. Inner uropod "considerably shorter than the outer, with four spines at the proximal end of the inner margin." The inner margin of the antennal acicle is figured as devoid of setæ—a character in which this species differs from the next.

Puget Sound.

Heteromysis spinosus, sp. nov.

Body quite robust and somewhat depressed. Rostrum triangular, acute. First and third joints of the antennular peduncle of subequal length; second joint very short, the inner side longer than the outer; sensory organ represented by a minute papilla; inner flagellum short, not one-half the length of the outer one. Antennal scale small, oblong-oval, ciliated on both sides and at the rounded extremity; peduncle reaching about to the tip of the acicle, the last joint about three-fourths the length of the preceding one; flagellum about equal to the outer flagellum of the antennules. Trunk of the mandibles short and strongly curved; first joint of the palp very short, second long, curved; the third joint much narrower and much shorter than the preceding one. Third maxillipeds large and stout, the penultimate joint with three pairs of spines on the inner margin; claw strong and curved. The succeeding thoracic appendages are slender; the terminal portions divided into 8–10 articulations and ending in a slender claw. The pleopods are uniramous, rudimentary, and of similar form. Telson triangular, with a deep, triangular, terminal notch, the margins of which are closely set with small spinules; sides of the telson armed with spinules throughout their length. Inner caudal lamella about three-fourths the length of the outer one, but much longer than the telson and scarcely widened at the base where the small auditory organ is located. Both lamellæ are strongly ciliated and rounded at the tip.

Length, one-half inch.

A single specimen taken at San Pedro, Calif., June, 1896.

Collection University of California.

Genus **Mysidopsis** *Sars*.

Carapace comparatively small and not covering all the thoracic segments. Antennal scale lanceolate, setose on both edges, with a short apical articulation. First and second thoracic appendages powerfully developed; legs unequal, comparatively short and stout, the propodal joint divided into three articulations, the terminal one having a slender setiform claw. Pleopods in the male all natatory. Telson comparatively short, the apex entire or cleft.

Type.—M. didelphys (NORMAN).

Mysidopsis elongata, sp. nov.

A small, slender species with a long, narrow, somewhat depressed abdomen. Rostrum rounded. Eye-peduncles reaching about to the middle of the antennal scale. In the stout antennular peduncle of the male the first joint is nearly as wide as long, the second joint much wider than long, and the third somewhat longer than wide and furnished with a well developed sense organ below and a foliate appendage on the inner side. In the more slender peduncle of the female the first joint is over twice as long as wide, the second longer than broad, the third nearly as long as the first and devoid of the appendage found in the male; the inner flagellum in both sexes is shorter than the outer one, which does not attain half the length of the body. Antennæ short, the acicle narrow, tapering, but not ending in a spine, and having both edges fringed with plumose setæ; peduncle slender and about two-thirds the length of the acicle. The pleopods of the female are small, slender and uniramous, while those of the male are large, biramous, and of similar form. Sixth abdominal segment about as long as the two preceding ones combined. Telson not one-half as long as the preceding segment and not reaching beyond the middle of the inner ramus of the uropods; its general form is triangular, but the sides converge more strongly in the basal half; the tip is broadly rounded and armed with numerous, short, closely set spinules, which do not extend in front of the posterior third of lateral margins. The inner rami of the uropods are shorter than the sixth abdominal segment, somewhat widened at the base where the auditory organ is situated, behind which the sides are nearly parallel to the abruptly rounded tip; outer ramus narrow, about one-half longer than the inner one and abruptly rounded at the end.

Several specimens caught at San Pedro, Calif., by Dr. H. P. Johnson, December 29, 1895. Collection University of California.

Genus **Siriella** *Dana.*

Carapace small, rostrate. Eyes normal. Antennal scale with the outer margin naked and produced distally into a spine. Legs subequal, the propodi entire or only two-jointed and furnished with a transverse row of setæ on either side of the strong, sharp, falciform claw. Pleopods rudimentary in the female, larger and biramous in the male and often furnished with two spirally twisted appendages at the base of the inner ramus. Outer ramus of the uropods larger than the inner, having an imperfect articulation near the tip, and the outer margin armed with spines. Telson elongated, the margins spinous and the apex entire. Auditory organ well developed.

The species of this genus are mostly pelagic and many of them have a very wide range.

Siriella pacifica, sp. nov.

Rostrum triangular, acute. Eyes large. Peduncle of the antennules reaching nearly to the tip of the antennal scale, the first joint larger than the next two and concave above; second joint wider than long and bearing two large plumose setæ at the distal end; third joint about twice as long as wide, with a single, large plumose seta near the middle of the inner margin and several similar setæ at the tip; inner flagellum about two-thirds the length of the outer. Antennal scale oblong, the straight outer margin ending in a spine; distal margin rounded, produced beyond the outer spine, and furnished, like the inner margin, with long plumose setæ. Upper lip subcordate and produced at the anterior end into a long narrow spine. Propodi of the thoracic legs two-jointed with a transverse row of setæ at the distal end on either side of the base of the dactyl. Dactyls claw-like, tapering to a sharp, curved tip, and having a transverse or oblique row of setæ at about the proximal third of their length.

Pleopods in the male rather small. Telson narrow, channelled above, somewhat constricted behind the base, the sides gently rounded and tapering from near the middle to the narrowly rounded tip; the sides and tip armed with spines; three large spines on each margin of the slightly widened base, behind which is a short interval at the constriction devoid of spines, beyond which the margin is closely set with spines to the tip; two somewhat larger spines at the distal end between which are three very short spines and a pair of plumose setæ. Inner ramus of the uropods narrow, scarcely expanded at the base, distally rounded, slightly exceeding the telson, setose on both margins and furnished with strong spines along the inner side. Outer ramus larger and much wider than the inner, the outer margin armed with (10–14) spines which begin about the anterior fourth of its length and extend, gradually increasing in size, to the articulated portion, where the ramus is somewhat constricted and beyond which the margin is furnished with plumose setæ.

Length 11 mm.

The color of several specimens preserved in formalin is white or a very pale pink. Pigment is scarce but on the posterior marsupial lamella of the females there is a pair of large, irregularly branched pigment spots, the two anterior lamellæ having each a single pigment spot.

Several specimens caught in a tow net at San Diego, Calif., October 15, 1898. A single female specimen taken at Santa Catalina Island, August 3, 1893. The marsupial pouch contained young embryos in specimens from both these localities.

Collection University of California.

This species resembles *Siriella Thompsonii* Milne-Edwards, but may readily be distinguished by the two-jointed propodi of the thoracic legs.

Family EUPHAUSIIDÆ.

Carapace rather small, not calcareous. Branchiæ arborescent, situated on the coxæ of the thoracic legs. Thoracic legs generally similar in form, the hinder pairs somewhat rudimentary. No marsupial lamellæ. Pereopods well developed and natatory in both sexes. Inner ramus of the uropods devoid of an auditory organ. Telson long and slender, with two long, spiniform appendages attached in front of the tip.

Genus **Thysanoessa** *Brandt.*

Carapace rostrate, the antero-lateral angles produced. Eyes large, the peduncles short. Antennules with the first joint flattened and devoid of a dorsal, leaf-like appendage; flagella short. Maxillipeds slender and not greatly elongated. First pair of legs much longer than the rest; merus and carpus elongated; propodus compressed, the margins furnished with strong setæ; last joint very short and setose. Penultimate pair of legs very small; endopod two-jointed. Last pair of legs quite rudimentary.

Type.—T. longipes BRANDT.

Thysanoessa spinifera, sp. nov.

Rostrum lanceolate from a triangular base, carinated above, the carina extending back some distance upon the carapace. A prominent spine on either side of the base of the rostrum. A small spine a very short distance above the acute antero-lateral angle of the carapace which is produced forwards; a sinus between this angle and the spines at the base of the rostrum. Eyes large, nearly spherical, the cornea occupying most of the surface. Antennules stout, the first joint flattened, about reaching the tip of the rostrum, the antero-external angle armed with a small spine; second joint prismatic, about two-thirds the length of the first but a little longer than the third. Antennæ scarcely half the length of the body, the last joint of the peduncle about three-fourths the length of the third, and reaching nearly to the tip of the acicle; acicle narrowly oblong, the sides nearly parallel, the tip reaching the tip of the second basal joint of the antennules; outer margin slightly concave, ending distally in a spine; inner margin slightly convex and furnished with long setæ; the distal end is broadly rounded, transverse, and furnished with setæ like the inner margin. Mandibles stout; terminal joint of the palp oblong-elliptical, the inner margin setose, the setæ increasing in length towards the tip, the terminal seta long and stout. Maxillipeds moderately long; first joint of the endopod short and tapering distally; second joint elongated, slender, about as long as the following joints combined; third joint longer than the fourth; last joint tapering, about three-fifths the length of the preceding one, the tip bearing a very long seta. First pair of legs (gnathopods) comparatively short for the genus, exopod two-jointed, the first joint not reaching the tip of the first joint of the endopod; second joint of the endopod slender and elongated, furnished with fine cilia on one margin; third joint furnished distally with long setæ and about as long as the two following joints combined; fourth joint with both margins furnished with strong setæ; terminal joint very short, furnished with four or five large setæ and several smaller ones. Second pair of legs with the exopod reaching the tip of the first joint of the endopod; third joint of the endopod about equalling the two following; last joint about one-fourth the length of the preceding one. The four succeeding pairs of pereopods are similar to the first but decrease successively in length posteriorly. The penultimate pair of pereopods is very small; the endopod is two-jointed, the tip of the first joint nearly reaching the tip of the exopod. The last pair of pereopods is probably represented by a minute styliform appendage on the last tuft of branchiæ. Abdomen slender, the lateral angles acute, the first five segments carinated above, the carinæ on the fourth and fifth segments ending posteriorly in a long spine; sixth segment rounded above but ending posteriorly in a small spine which is curved downwards. Telson long, deeply channelled above, the anterior fourth with the sides nearly parallel, the posterior portion tapering to the acute tip; subapical spines extending beyond the tip; a pair of marginal spines near the middle of the dorsal surface and another pair above the bases of the subapical spines. Uropods subequal to the telson, the inner ramus narrowly lanceolate; outer ramus much broader and slightly longer than the inner, the outer angle subacute.

Length, 30 mm.

Taken near Fort Bragg, Calif., June, 1894.

This species may be distinguished from *T. longipes* Brandt by its more slender rostrum, differently shaped antennal scale, by having the third basal joint of the antennules shorter, instead of longer than the second, and in having the first pair of pereopods considerably shorter. The corneæ are nearly round and not divided by a constriction into an upper and a lower portion as in *T. gregaria* and *macroura* described by Sars.

Collection University of California.

Thysanoessa gregaria *Sars.*

Thysanoessa gregaria SARS, Forhandl. Videnske. Selsk., Christiania, No. 7, 1883; Challenger Reports, Vol. XIII, 1885, p. 120, Pl. XXI, figs. 8-17; Pl. XXII, figs. 1-30.

Rostrum large, triangular, acute; antero-lateral angle of the carapace produced into a sharp, triangular process; lower margin of the carapace with a small tooth behind the middle. Eyes very large, subglobose, the upper part of the large cornea constricted; an incision between the smaller

upper portion of the cornea and the peduncle. First basal joint of the antennules elongated, flattened, and armed with a spine at the antero-external angle; second and third joints of subequal length; flagella shorter than the peduncle. Second basal joint of the antennæ longer than wide, with a slender spine at the antero-external angle; third joint very short; last two joints very slender, the terminal one not quite reaching the tip of the narrow acicle. Legs short, diminishing in length posteriorly, the first pair much longer than the others, and geniculated, the terminal joint very short. Abdomen smooth above, none of the segments produced into spines. Telson very narrow, the apex acuminate, the subapical spines smooth and reaching a short way beyond the tip; dorsal surface with two pairs of small spines. Inner ramus of the uropods very narrow and about reaching the tip of the telson; outer ramus broader and somewhat shorter than the inner, the postero-external angle acute. Preanal spine in the form of a broad plate, the posterior margin of which is armed with spinules.

Length, 18 mm.

Numerous specimens taken in tow at Avalon, Santa Catalina Island, August 13, 1893.

This is a pelagic species and is very extensively distributed in the Atlantic and Pacific oceans, both north and south of the equator.

APPENDIX.

A few species have recently been reported as occurring in the area covered by this paper which have not been mentioned in the preceding pages. Some new species also have been added, and certain changes made in nomenclature after the proof of most of the paper had been corrected and returned. For the sake of completeness a short account of these contributions is given in the following notes.

Philyra pisum *De Haan.*

Philyra pisum De Haan, Fauna Japonica, Crust., 1850, p. 131, Pl. XXXIII, fig. 7. Ortmann, Zool. Jahrb. Abth. f. Syst., Bd. VI, 1892, p. 582, Pl. XXVI, fig. 16. Calman, Ann. N. Y. Acad. Sci., Vol. XI, No. 13, 1898, p. 262.

This species has been recently reported from Puget Sound by Calman. "A single male specimen," says Calman, "lacking both chelipeds and some of the ambulatory legs, is referred to this species. I have been able to compare it with two specimens dredged in Yokohama Bay by Professor D'Arcy Thompson, and also with three specimens from the Strassburg Museum identified by Dr. Ortmann (l. c.), and sent to us by the great kindness of Professor L. Döderlein, by whom they were collected in the same neighborhood. The resemblance in both cases is so exceedingly close that in spite of the imperfection of the Puget Sound specimen I have no hesitation in adding *P. pisum* to the list of species inhabiting both sides of the North Pacific."

Pagurus Middendorffii *Brandt.*

Pagurus (Eupagurus) Middendorffii BRANDT, Middendorff's Siberische Reise, Bd. II, Th. 1, 1851, p. 108, Pl. V, figs. 1-16.
Eupagurus Middendorffii STIMPSON, Journ. Bost. Soc. Nat. Hist., Vol. VI, 1857, p. 482; Proc. Acad. Nat. Sci. Phila., 1858, p. 250. CALMAN, Ann. N. Y. Acad. Sci., Vol. XI, No. 13, 1898, p. 260.

This species has recently been reported from Puget Sound by Calman. It was reported by Brandt from Okhotsk Sea and Sitka, Alaska, and later by Stimpson from Japan.

Pagurus splendescens *Owen.*

Pagurus splendescens OWEN, Zoölogy Beechy's Voyage, 1839, p. 81, Pl. XXV, figs. 1 and 1*a*.
Eupagurus splendescens CALMAN, Ann. N. Y. Acad. Sci., Vol. XI, No. 13, 1898, p. 260.

This species also has been found by Calman to range as far south as Puget Sound. It is quite different from the other species of *Pagurus* here described. The carapace is very short and broad and much harder than in the other species, the whole surface being "granulate, much resembling the back of a toad." The front is tridentate and the rostrum is very long, reaching beyond the middle of the short, stout eye-stalks. The antero-lateral angles of the branchial regions are produced forwards into a prominent process. The antennæ are longer than the chelipeds and the acicle is acute and "notched along the upper part." The chelipeds are elongated, very unequal in size, hirsute and granulate below; "above they bear long rows of small tubercles and reflect hues of green and gold with metallic lustre; a pink hue is also reflected in some positions." Dactyls of the left hand long and curved downwards. Ambulatory legs longer than the chelipeds, the dactyls twisted. Kamtschatka (Owen).

Spirontocaris spinus *(Sowerby)*.

Cancer spinus SOWERBY, Brit. Misc., 1806, p. 47, Pl. XXI.

Hippolyte spinus OWEN, Appendix to Ross's Second Voyage, 1835, p. lxxxiii, Pl. III, fig. 2.

Spirontocaris spinus BATE, Challenger Reports, Vol. XXIV, 1888, p. 596, Pls. CVI and CVII.

For further references and synonyms, see BATE, l. c.

A short, robust species. Rostrum beginning at the posterior end of the carapace as a carina, which is strongly arched and armed with four or five large teeth; the lamina or rostrum proper is high, much shorter than the carapace, more or less truncated at the tip, and armed above with several teeth which decrease in size anteriorly; lower side strongly curved distally and armed with one or more teeth. Two supra-orbital teeth on either side, the posterior one the larger. A prominent antennal spine and a smaller spine at the antero-inferior angle of the carapace. Outer spine at the base of the antennules large, about reaching the tip of the third joint of the peduncle. Acicle extending beyond the rostrum. Maxillipeds stout, exceeding the rostrum, the terminal joint flattened, about four times the length of the preceding joint, the tip armed with spines; exognath not reaching the tip of the antepenultimate joint. First pair of chelipeds rather slender. Third carpal joint of the second pair longer than the first and second combined, but not twice as long. Dactyls of the ambulatory legs short and spiny below. Third segment of the abdomen produced backward into a prominent beak.

This species has been reported from very near our limits, and as it is very closely allied to *S. lamellicornis* (Dana), and will probably be found to occur along with that species, this description is inserted in order to distinguish the two forms. I have not seen any representatives of *S. spinus* from the Pacific coast, but Dana's description and figures of *lamellicornis* agree quite closely with specimens of *spinus* that I have from the north Atlantic. It is possible that the so-called western representatives of *spinus* belong to Dana's species, for the differences between the two forms are not greater than those often found between widely separated members of an extensively distributed species. The third joint of the carpus of the second pair of chelipeds is somewhat larger in *lamellicornis* than in *spinus*, and the rostrum is also larger. The chief difference, however, between the two species seems to be in the dactyls of the ambulatory legs; in *spinus* they are rather stout and strongly spiny below, while in *lamellicornis* they are more slender and nearly devoid of spines, having only a few minute spinules near the base.

Spirontocaris grœnlandica *(Fabr.)*

Astacus grœnlandicus FABRICIUS, Syst. Ent., 1775, p. 416.

Hippolyte grœnlandica MIERS, Ann. Nat. Hist. (4), Vol. XX, 1877, p. 62. SMITH, Rep. Prog. Geol. Sur. Canada, 1878–9, *B*, p. 214; Trans. Conn. Acad. Sci., Vol. V, 1880, p. 85, Pl. X, fig. 2. CALMAN, Ann. N. Y. Acad. Sci., Vol. XI, 1898, p. 260.

Spirontocaris grœnlandica WALKER, Trans. Liverpool Biol. Soc., Vol. XII, 1898, p. 276.

This species, which has previously been mentioned as having been reported by Professor S. I. Smith from Queen Charlotte's Islands, has been found both by Walker and by Calman to occur in Puget Sound. The carina on the carapace extends about to the posterior margin and is armed with four large teeth; the rostrum is short and very slender, scarcely higher than wide, and projects nearly straight in front; the upper margin is armed with from two to four spines, the lower with two or three. Maxillipeds robust, exceeding the acicle. Anterior chelipeds stout. Ambulatory legs rather stout, spiny, the dactyls short and spiny below. Sides of the segments of the abdomen acute.

I have not seen western representatives of this species.

Miss M. J. Rathbun has recently made *Lophoxanthus bellus* (Stimpson) the type of a new genus *Lophopanopeus*,[1] in which are included also *Lophoxanthus leucomanus* (Lockington) and *L. frontalis* (Rathbun). In her key to the Cyclometopa of North America[1] Miss Rathbun gives the names of three new species of *Lophopanopeus* from the Pacific coast, *Lophopanopeus Lockingtoni* and *diegensis* from San Diego, Calif., and *L. Heathii* from Monterey. Fuller accounts of these species, it is stated, are soon to appear in the Proceedings of the United States National Museum. *Lophopanopeus Heathii* has the carpus of the chelipeds smooth, or nearly so, as in *frontalis*, but the color of the pollex does not extend back upon the hand. *Diegensis* and *Lockingtoni* have the carpus very rough as in *leucomanus*. *Lockingtoni* is said to be distinguished from *leucomanus* and *diegensis* by the slightly bilobed carpal joints of the ambulatory legs; *diegensis* has the carpus of the chelipeds covered with tubercles and not with reticulating ridges as in *leucomanus*.

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[1] Bull. Lab. Nat. Hist. State Univ. Iowa, 1898, p. 272.

A new species of *Cancer*, *C. Jordani* from Monterey, is also announced in the same paper. In this species the fronto-orbital width is nearly half the width of the carapace. The carapace is slightly areolated and the antero-lateral teeth are strong and projecting. The carpus of the chelipeds has two spines at the inner angle, the one above the other. *Cancer Anthonyi* is reported in the key from the region between Monterey and San Diego; it was originally described from Playa Maria Bay, west coast of Lower California.[2] Miss Rathbun does not recognize the genus *Trichocarcinus* as distinct from *Cancer*.

Reference may be made to two articles contributed by Prof. J. S. Kingsley to the "Synopses of North American Invertebrates," published by the American Naturalist.[3] The first article consists of a key to the species of

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[1] American Naturalist, Vol. XXXIV, Feb., 1900, p. 131.

[2] Proc. Biol. Soc. Washington, Vol. XI, 1897, p. 111

[3] American Naturalist, Sept. and Oct., 1899.

Caridea of North America. The species occurring within or near our limits of which figures are given are the following: *Alpheus æqualis (=Harfordi)*; *Caridina pasadenæ*; *Crangon boreas; Crangon munitellus; Crangon munitus; Crangon franciscorum; Hippolyte affinis; Hippolyte californiensis; Hippolyte Gaimardii; Hippolyte Layi; Hippolyte Phippsii; Hippolyte polaris; Heptacarpus brevirostris, Herdmani* and *palpator* (as *Hippolyte*); *Hippolysmata californica; Palæmon Ritteri; Pandalus Danæ; Pandalus pubescentulus; Paracrangon echinatus; Syncaris pacifica* (as *Acanthephyra*). The large cheliped of *Alpheus Candei* is figured, but whether the specimen from which the figure was drawn came from the eastern or western coast of North America is uncertain. The figure resembles the cheliped of *Alpheus clamator*, and may have been taken from a specimen of that species (see p. 184).

The species here described as *Syncaris pacifica* is placed by Kingsley in the genus *Acanthephyra*. The type of *Acanthephyra*, viz., *A. armata* A. Milne-Edwards[1] is, however, a marine species belonging properly to a different family from that which includes *Syncaris*. In *A. armata* the abdomen is carinated and the rostrum extends back as a carina upon the carapace; there is no supra-orbital spine, and the mandible is provided with a two-jointed palp. In *Syncaris* neither the carapace nor the abdomen is carinated, a supra-orbital spine is present, and the mandible, as in the other genera of the Atyidæ, is devoid of a palp.

The second article consists of a key to Astacoid and Thallassinoid Crustacea. Figures are given of the chelipeds of *Upogebia pugettensis*, *Callianassa gigas*, *longimana* and *californiensis*.

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[1] Ann. Sci. Nat. (6), T XI, 1881, Art. No. 4, p. 12.

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ERRATA.

Page 60, in synonymy, for *Xanthodes Hemphilliana* read *Xantho Hemphilliana.*

Page 82, fourth line from bottom should read, "*Heterograpsus oregonensis* STIMPSON," etc.

Page 128, fourth line from bottom, for *Echinocerus sentimanus* read *Echidnocerus setimanus.*

Page 128, reference to *Ctenorhinus setimanus*, page 48 in first edition of Proc., page 47 in second edition; reference to *Echidnocerus setimanus*, page 88 in first edition of Proc., page 96 in second edition.

Page 137, in synonymy, for *Eupagurus ochotensis* read *Pagurus (Eupagurus) ochotensis.*

Page 137, in center of page, strike out ( ) around Brandt.

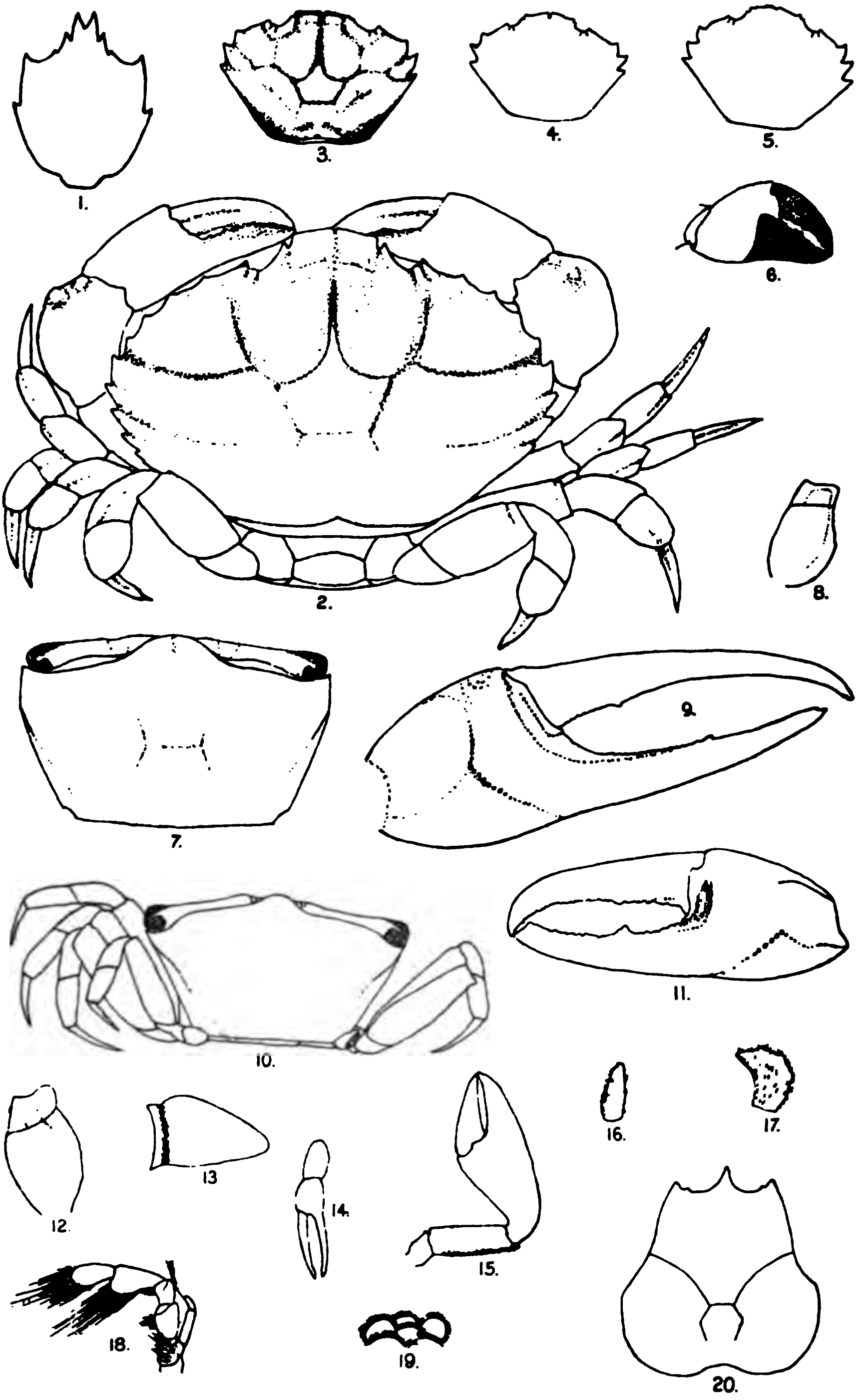
Page 194, second line from bottom, after "Island" insert "and Queen Charlotte Islands."

EXPLANATION OF PLATE I.

The figures were drawn by means of a camera lucida.

Fig. 1. *Epialtus productus*, carapace.
Fig. 2. *Cycloxanthops novem-dentatus.*
Fig. 3. *Lophoxanthus bellus*, carapace.
Fig. 4. " *leucomanus*, carapace.
Fig. 5. " *frontalis*, carapace.
Fig. 6. " " hand.
Fig. 7. *Uca crenulata*, carapace.
Fig. 8. " " outer maxilliped.
Fig. 9. " " inner side of large hand.
Fig. 10. " *rectilata*, carapace.
Fig. 11. " " inner side of large hand.
Fig. 12. " " maxilliped.
Fig. 13. " " merus of large cheliped.
Fig. 14. " " carpus and hand of small cheliped.
Fig. 15. *Petrolisthes eriomerus*, cheliped.
Fig. 16. *Dermaturus Mandtii*, acicle.
Fig. 17. *Œdignathus Brandtii*, acicle.
Fig. 18. " " outer maxilliped.
Fig. 19. " " squamæ of the carapace (enlarged).
Fig. 20. " " outline of the carapace.

Oc. Papers, Cal. Acad. Sci. Vol. VII. [Holmes] Plate I.

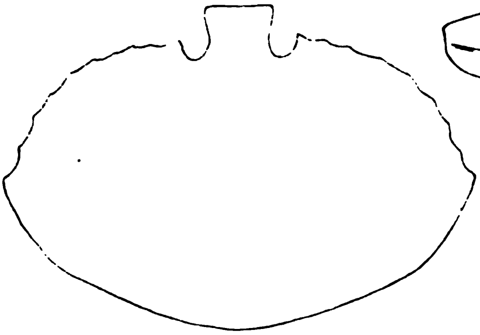


HOLMES, DEL.

LITH BRITTON & REY, S.F.

EXPLANATION OF PLATE II.

Fig. 21. *Cryptolithodes sitchensis*, carapace.
Fig. 22. " " large hand.
Fig. 23. " " small hand.
Fig. 24. " " last two joints of ambulatory leg.
Fig. 25. " " abdomen of a female.
Fig. 26. *Paguristes parvus*, eyes and anterior portion of the carapace.
Fig. 27. *Callianassa californiensis*, large cheliped of a male.
Fig. 28. " *longimana*, large cheliped of a male.
Fig. 29. " *affinis*, large cheliped of a male.
Fig. 30. " " small " same specimen.
Fig. 31. *Crangon nigricauda*, acicle.
Fig. 32. " *nigromaculata*, acicle.
Fig. 33. " *stylirostris*, anterior portion of the carapace.
Fig. 34. " " hand.
Fig. 35. " " acicle.
Fig. 36. *Paracrangon echinatus*, carapace (after Dana).
Fig. 37. " " hand " "
Fig. 38. *Hippolysmata californica*, carapace.
Fig. 39. *Alpheus clamator*, large hand.
Fig. 40. " " small hand.
Fig. 41. " *bellimanus*, large hand.
Fig. 42. " *californiensis*, anterior part of carapace.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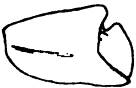
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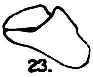
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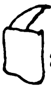
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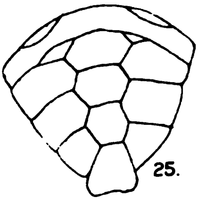
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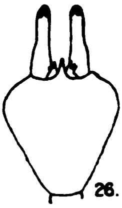
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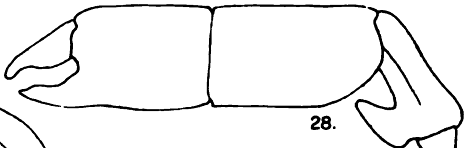
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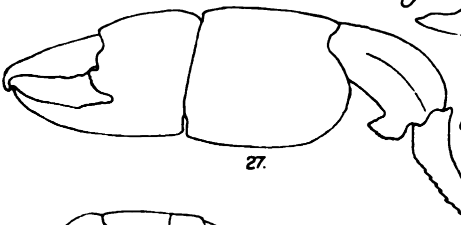
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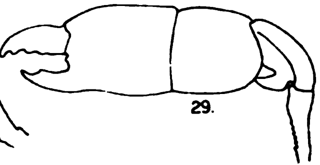
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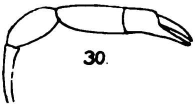
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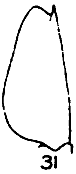
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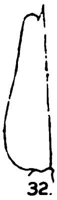
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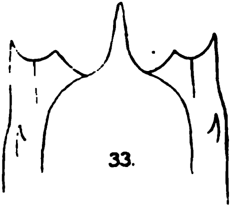
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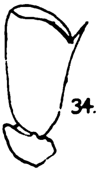
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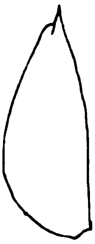
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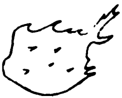
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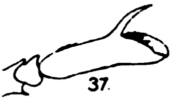
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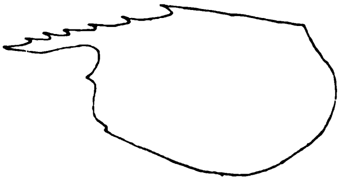
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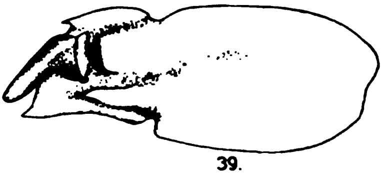
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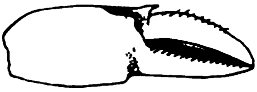
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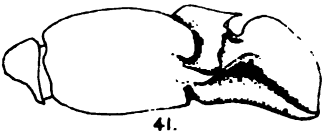
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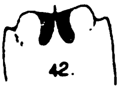
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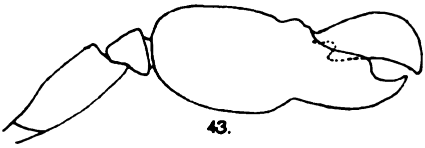
EXPLANATION OF PLATE III.

Fig. 43. *Alpheus californiensis*, large hand.
Fig. 44. " " small hand.
Fig. 45. " *equidactylus*, large hand.
Fig. 46. " " small hand.
Fig. 47. " *æqualis*, hand.
Fig. 48. *Heptacarpus palpator*, carapace.
Fig. 49. " " acicle.
Fig. 50. " *brevirostris*, carapace.
Fig. 51. " " acicle.
Fig. 52. " *Taylori*, carapace.
Fig. 53. " " acicle.
Fig. 54. " *pictus*, carapace.
Fig. 55. " " acicle.
Fig. 56. " *paludicola*, carapace.
Fig. 57. " " acicle.
Fig. 58. " *cristatus*, carapace.
Fig. 59. " " first ambulatory leg.
Fig. 60. " *carinatus*.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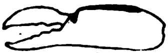
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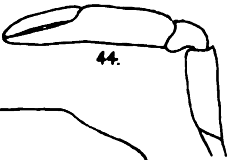
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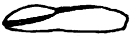
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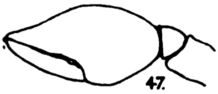
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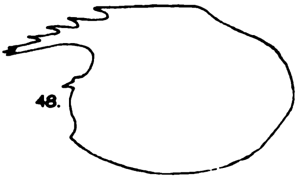
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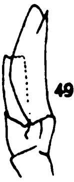
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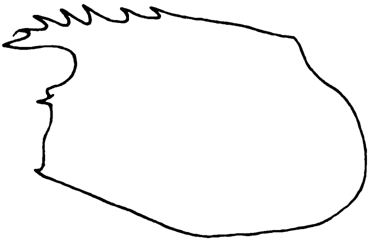
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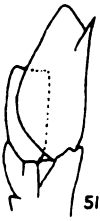
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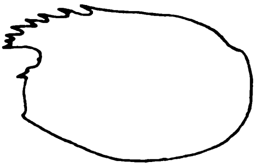
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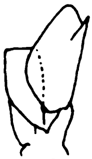
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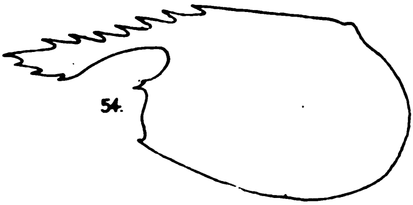
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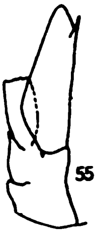
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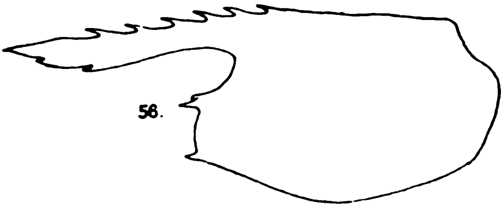
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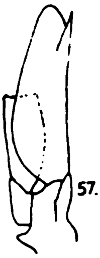
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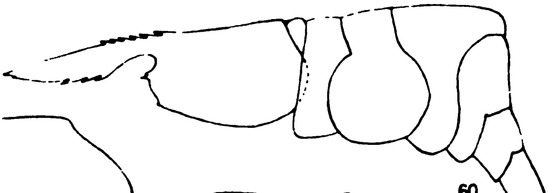
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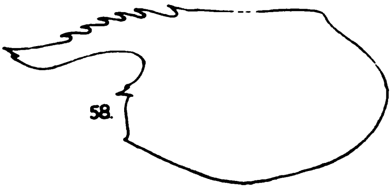
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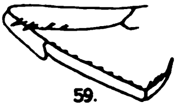
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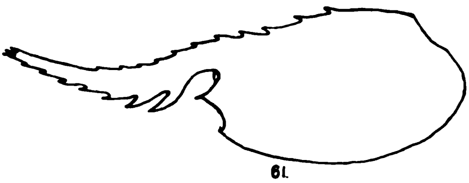
EXPLANATION OF PLATE IV.

Fig. 61. *Pandalus Danæ*, carapace.
Fig. 62. " " acicle.
Fig. 63. *Syncaris Trewi*, carapace.
Fig. 64. *Penæus californiensis*, carapace.
Fig. 65. " " hand and carpus of first pereopods.
Fig. 66. " " hand and carpus of second pereopods
Fig. 67. " " hand and carpus of third pereopods
Fig. 68. " " abdomen.
Fig. 69. " " acicle.
Fig. 70. *Mysis costata*, telson and outline of uropods.
Fig. 71. " " antenna.
Fig. 72. " " fourth pleopod of a male.
Fig. 73. *Heteromysis spinosus*, antenna.
Fig. 74. " " third maxilliped.
Fig. 75. " " thoracic leg.
Fig. 76. " " telson and outline of uropods.
Fig. 77. *Mysidopsis elongata*, antennule of the male.
Fig. 78. " " antennule of the female.
Fig. 79. " " antenna.
Fig. 80. " " telson and uropods.
Fig. 81. *Thysanœssa spinifera*.



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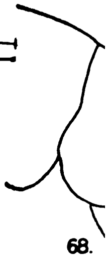

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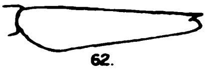

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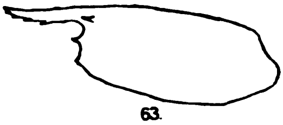

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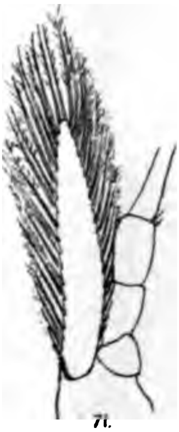

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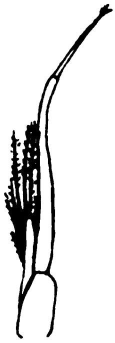

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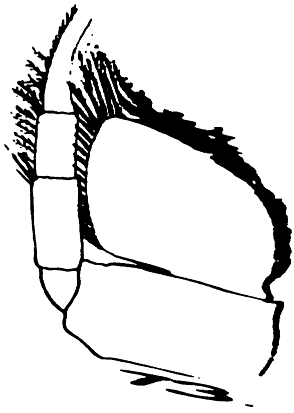

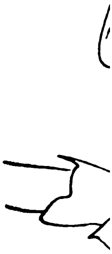

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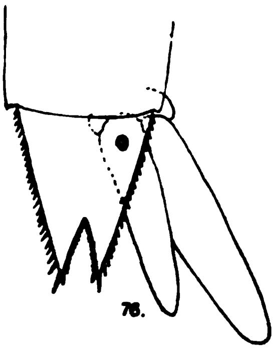

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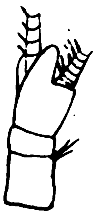

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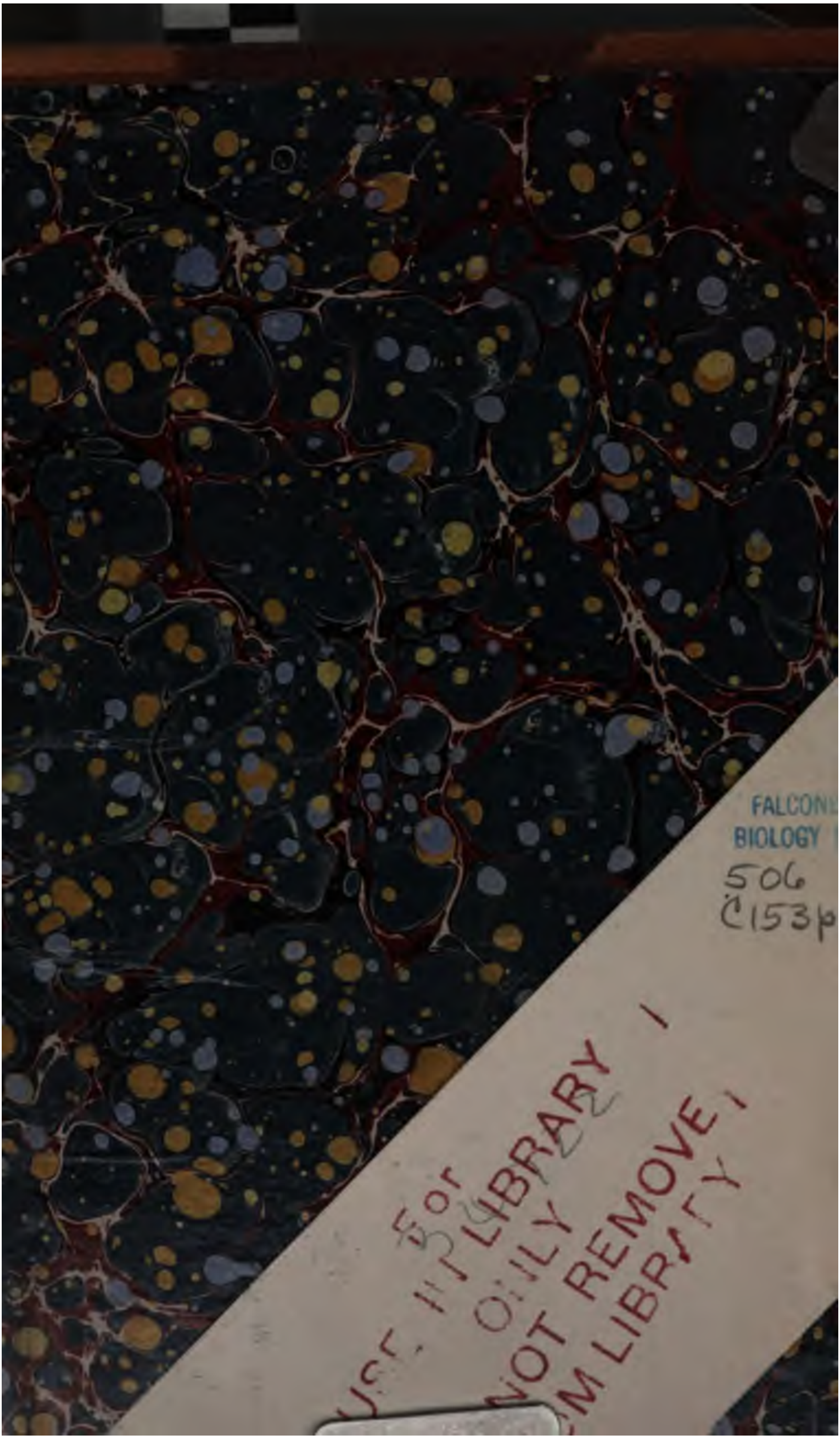

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